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Forming Representative Committees

COMMITTEE work is so important a factor in successful organization that association executives study with care to make it effective. A means of accomplishing this is the appointment of strong men who are keenly interested and who represent different geographic sections and varying practices. It is understood that in some of the appointments for the coming year President Lloyd of the National Electric Light Association, instead of confining the membership to the particular department of the industry directly concerned, will try to carry out in an experimental way the idea of selecting members from different branches of the business. For instance, the meter committee would include a commercial representative, whose work affords another point of view. If the plan works well in practice, undoubtedly as opportunity offers it will be extended to other committees. Where organization is as thorough as in the central-station industry, the tendency to departmentalize even committee work is almost irresistible; but if one part earnestly considers the duties and responsibilities of another part, that broad vision which higher officials have will be extended.

Western Water-Power Conference

THE resources of the West, together with the unselfish devotion of its leading men to civic interests, make the forthcoming water-power conference in Portland one of great promise for the electrical industry. There are on the Pacific Coast numerous latent water-powers susceptible of economical development which if utilized would add materially to the wealth of the section and contribute to the welfare and happiness of its people. Unfortunately these sites lie on the public domain and can only be made available by act of Congress. Every time federal water-power legislation is proposed, however, radical conservationists cry wolf, with the result that the unfettered waters dash down apace and so much potential energy is lost to the world. It is the purpose of the conference to consider seriously the Ferris bill and to suggest such amendments as will make it practicable to insure development in conformity with the public interests and at the same time permit of proper protection to invested capital. Obviously the federal government should put a stop to wanton waste of power, either by making the developments itself or by permitting private capital to do so. What with federal ownership of the sites on the one hand and effective regulation by State commissions as to service and rates on the other, there can be no question of loot. Private capital is available for developing the water-powers if reasonable assurance of security for the investment is forthcoming. To permit the water-powers on the public domain to lie dormant when their development is so vital to the continuous prosperity of the Pacific Coast is an economic crime not only against the West but against the entire country. The conference of Governors, we trust, will bring order out of chaos and point the way to a lasting solution of this vexing problem.

Giving Experience a Voice

A LETTER of engineers on constitutional revision in New York emphasizes the importance of continuity in office in the Public Service Commissions. Unless the pending constitutional revision makes some change, this is substantially assured by the present law, barring, of course, the possibility of removal of the commissioners by the Governor on sustained charges. If the commissions are not to be political footballs, the preservation of this principle is of foremost importance. It is of much interest to the ELECTRICAL WORLD to see that the committee urges that experienced men be appointed. "There are to be found among those connected with public utility companies men with as broad conceptions of public rights and of the duties to be fulfilled to the public," it says, "as can be found in other walks of life." The appointment of public utility operators on commissions is a practice which this journal has recommended. They have qualifications which cannot be obtained elsewhere. By using their abilities in the development of the co-operative relations which should exist between the great body of consumers and the aggregations of public utility capital they can render a fine and much-needed service in the community.

The Market Value of a Reputation

NO definite market value can be placed upon one of the best central-station assets, a long, satisfactory record of sound public policy. In any appraisal based on modern commission methods it could not be listed as a tangible item. It cannot be expressed as worth so many per cent to the quoted price of the common stock or as assuring extra dividends. Yet a continuing history of management without undue public friction, of a public good will won by excellent service and friendliness and co-operation in the welfare of the community, carries a value upon which the holder can realize. Its true worth is appreciated in financial markets where close bargains are the rule. This fact is brought out

by a recent costly investment of a holding company. The first chapter in the experience was the purchase of control of a property after financial and operating investigations, but without thorough consideration of the reputation of the company with its public; the next, an outbreak from a smoldering public discontent, and the last is the better era which is expected only from careful management for years to come. The admitted mistake was in the acceptance of the property after a survey of operating features and in the unquestioning assumption that a reasonable public policy attitude prevailed. Poor operating conditions are less of a handicap than consumers made hostile by unwise methods.

Need of Accurate Generating-Cost Data

It is hardly necessary to reiterate the importance to those confronted with a choice between the two methods of placing due weight on the points which give the central station its advantages as compared with the individual factory power plants, but to make this possible in existing plants it is almost essential that accurate cost data be used as the starting point for ascertaining the value of the privately developed power. The central station obviously possesses such accurate cost data, which form the basis of its quoted rates, while the individual plant, forming only one portion of the entire shop, opens the way for the omission of general charges which should rightly be apportioned against the power supply, typified, for example, by interest, depreciation, and other indirect expenses normally chargeable against the power house.

Apparently, then, those smaller private plants which compute their power expense only on a basis of coal and labor often fall into the error of self-deception regarding the actual conditions. This feature of estimating power costs is probably more largely responsible than any other for many of the misunderstandings involved in the relative advantages of the two methods of supply. Again, in the case of the new shop or factory, the purchase of power removes the investment for a new power house, thus reducing the capital required at the start or making available additional resources for other items, which may have a far more important bearing on the manufactured product for which the concern has been promoted.

In manufacturing establishments about to be constructed it therefore becomes of extra importance to investigate beforehand the proposed rates of central-station supply and to weigh these against a fairly computed probable cost of power through a private plant. To this should be added those other factors of reliability and freedom from the responsibilities incident to a private plant, all of which in their way form assets favoring the central-station scheme. In those shops already in operation which possess their own plants the availability of central-station power may make it of economic value to ascertain the exact costs of their own power, which can be used as a working basis in reaching satisfactory conclusions.

Sag-Tension Calculations Without Charts

The erection of aerial transmission lines over a series of towers does not in itself make an electrical task. It is essentially a task in statics, and might be regarded as falling within the province of the civil engineer. Nevertheless, in the work of installing a complete electric power-transmission system, the proper erection of the lines often falls to the duties of an electrical engineering staff, so that it is not surprising to find the theory of the design and installation of such overhead lines occupying space in electrical engineering textbooks and tables. The theory of the tension in such lines is associated with the geometry of the case. Strictly speaking, the plane curve in which a flexible uniform conductor will lie, in still air, between two fixed points of support, is that of the elastic catenary; but the difference between the elastic catenary and the much simpler ordinary catenary is so small that the latter is always followed. The ordinary catenary curve, in its turn, differs so little from a simple parabola, under ordinary conditions of suspension, that the parabola is used as the basis of computation in nearly all engineering computations.

The problem which presents itself in practice is how much sag or tension a span of given length of a given conductor should have in order that when the temperature falls to, say, 15 deg. C., and a coating of ice, say, 1 cm. thick forms on the wire, with a transverse wind blowing at a rate of, say, 30 km. per hour, the wire shall still have a considerable margin of tensile strength in reserve. The solution of this problem can be worked out either graphically, by the use of specially prepared charts, or algebraically, by the use of working formulas. When an engineer is continually engaged on such work, the chart is probably the more satisfactory means of arriving at solutions; but where only a relatively small number of cases have to be worked out at any one time, the formula is perhaps preferable to the chart, which has to be investigated to become familiar. The algebraical solution involves finding the roots of a cubic equation. Such an equation always has at least one real root, and in this class of cubic equations the required root is the single real root, the other two roots being complex quantities and not usually needed in the solution.

In the article on sag-tension calculations without charts, appearing on page 344 of this number, Prof. Harold Pender expresses the cubic equation which it is desired to solve, and then indicates a swift method of evaluation, with the aid of a special auxiliary table contained in the article. This method should be very helpful to the engineer, if only in furnishing a check upon graphical methods. The plan which Professor Pender adopts in working out a speedy solution is the well known but not much used method of finding the roots of a cubic equation by means of an auxiliary hyperbolic angle, or in certain cases of an auxiliary circular angle. To make the method of wider application in the industry, the author might have included a corresponding formula for working out a case expressed in

metric units. It would be a formula of the same type as the one given by Professor Pender, but with altered constants to suit metric equivalents.

The Development of the Gas-Filled Lamp

It is interesting to observe the practical development which the gas-filled lamp is undergoing. In Europe the lamp masquerades under its early name of "half-watt," although it is hardly to be expected that this specific consumption is approximated except in the larger sizes. Theoretically as well as practically, the greatest gains are to be secured by rather a heavy current in the filament of such lamps, yet there is a material improvement in efficiency due to gas filling even in the smaller sizes. In this country lamps of 100 watts and less have only been used in a most tentative way and cannot be considered as fully in regular manufacture as yet, although 60-watt lamps, curiously enough, are made for export. Abroad 60-watt gas-filled lamps are regularly being put out for ordinary voltages of 110 or thereabouts, while 50-volt, 30-watt lamps are available and 25-volt lamps are often employed in car lighting. Even the 15-watt lamps are now gas-filled. There is no doubt, therefore, that the gas-filled lamp has come to stay even in moderately small ratings. Granted that the gain in efficiency may not be very great or perhaps even material at present, there is an interesting possibility in gas filling which may lead to further improvements. As is now well understood, one of the great gains in the use of inert gas is the lessened evaporation from the filament. It would certainly seem to be possible that this effect may even render practicable the use of alloy filaments of a higher specific resistance and hence of more favorable dimensions than pure tungsten. Even granted that the gain in efficiency might be small, a lamp with a fairly thin and strong filament for ordinary voltages would lead to a simpler structure and longer life than is now found. Although experiments along this line have not yet yielded any commercial result, they seem to foreshadow a reasonable chance of success.

International Standardization Rules

The American Institute of Electrical Engineers was the first national society to prepare a set of standardization rules. Since 1899 this example has been followed in other countries, particularly in Great Britain, Germany and Italy. In each case the mode of procedure has been similar to that followed in America, but the details of the various national rules, as first issued, differed materially in the different countries. This difference was inevitable, and may be attributed to national differences of custom and of manufacture. The immediate consequence, however, of the publication of parallel sets of different rules in different countries was to initiate a movement to bring these sets into harmony so far as is necessary for defining and establishing the rating of machines.

It is manifestly desirable that the spontaneous tendencies to differentiate nationally in designs and constructions should be unhampered. By encouraging such differentiation improvements in machines are the more likely to come about. But it is also manifestly desirable that the physicial behavior of machines, as defining their rating, should be stated, measured and determined in substantially the same way all over the globe. Indeed, any other conclusion on this point becomes impossible if free commercial intercourse between nations is to be fostered.

With these ends in view, the International Electrotechnical Commission was formed to carry out the project of an international set of rules whereby the terms used should be internationally defined and the rating of machinery internationally agreed to. In the decade which has elapsed since the I. E. C. was formed marked progress has been made toward this goal. The all-devouring world war has, indeed, temporarily brought the movement to a halt, but it is probable that after the war is over the I. E. C. will resume its work all the more effectively.

In numbers of the *Elektrotechnische Zeitschrift* this spring an analysis of the A. I. E. E. 1914 Standardization Rules has been published by Mr. L. Schüler, in critical comparison with the latest edition of the corresponding German rules, issued by the V. D. E. Only part of the American rules are included in the analysis, but it is interesting to see how fairly the two sets of national rules conform. They by no means coincide in regard to the establishment of rating, so that one and the same machine might readily have a distinctly different rating in the two countries. Nevertheless, it would not require very much alteration between them to bring the rules into substantial agreement on this matter, a reflection which should encourage the I. E. C.

Certain criticisms are offered in the article against the A. I. E. E. rules. Some do not appeal to us, while others appear to us as well founded. Among the latter, in particular, is a criticism against the "nominal rating" of railway substation machinery, which differs from that of other kinds of substation machinery in virtually requiring a thermal overload guarantee. It is earnestly to be hoped that the A. I. E. E. railroad committee will succeed in eradicating this archaic and illogical thermal-overload requirement, so as to bring railroad substation machinery into line with other electric-service substation machinery. Under properly defined thermal conditions, there is one and only one load which such machinery can carry without exceeding the temperature limits already conventionally adopted. It is, therefore, surely simpler and more logical to adopt that one load as the basis of rating than to insist upon a sort of fictitious thermal bonus from an overload capacity, which only complicates the test conditions and adds to the cost, without adding to the sum total of human happiness. Extra thermal output constitutes an excessive overload, which may not be permissible on other grounds, such as commutation, stalling load, structural strength, etc., and is only available at owner's risk.

RESTORING ELECTRIC SERVICE IN ERIE

Hearty Co-operation Generously Extended by the Electrical Industry to the Erie County Electric Company

Overcoming great difficulties after its French Street station had been completely wrecked by the flood which tore through that part of the city of Erie, Pa., on the night of Aug. 3, the Erie County Electric Company, with the hearty co-operation of several electrical companies, experts and men well known in the business, has succeeded in restoring normal service. At the crest of the flood there was 20 ft. of water in the company's station and tunnels, covering the engine foundations with more than 2 ft. of mud and choking the machines with sand and grit. The engine-driven generators were completely submerged, and it was several days after the flood receded before the machines were finally dried out and ready for operation.

As soon as information of the flood reached the outside world generous offers of assistance immediately poured into the offices of the company from every side. Immediately after the flood dropped, the Burke Electric Company of Erie sent several electrical experts and also station apparatus, by means of which the company was able to give partial service the third night after. The Cleveland Electric Illuminating Company sent twelve men to assist on inside and station equipment and rebuilding of lines in order that the company might deliver energy for street-lighting purposes promptly. Mr. S. D. Sprong, electrical engineer of the Edison Electric Illuminating Company of Brooklyn, was also dispatched to assist in getting back into shape the badly damaged and sand-riddled station equipment.

The Pittsburgh and Cleveland departments of the Westinghouse Electric & Manufacturing Company sent experts to repair equipment completely put out of commission by the flood waters. The General Electric Company sent a number of experts and also dispatched by fast freight a large portable motor-generator set from its works at Schenectady. This arrived in Erie last Saturday and was placed in commission the following morning. Several machinists sent from the Ball Engine Company of Erie took the sand and grit out of the engines and renewed the bearings. The Erie Lighting Company meanwhile took care of as much of the load as could be carried by its system. The accompanying telegrams show the promptness with which aid was offered to the company from nearby cities:

NEW YORK, 12.11 p. m., Aug. 4, 1915.

THOMAS G. O'DEA, Treasurer Erie County Electric Company, Erie, Pa.:

Learn with regret of your trouble. If we can be of any assistance, command us.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES,
W. F. WELLS, President.

CLEVELAND, OHIO, Aug. 5.

ERIE COUNTY LIGHT COMPANY:

Foreman Howlett and ten men will arrive 10.03 to-night.

CLEVELAND ELECTRIC ILLUMINATING COMPANY.

BROOKLYN, N. Y., Aug. 5, 11.50 a. m.

THOMAS G. O'DEA, Treasurer Erie County Electric Company, Erie, Pa.:

S. D. Sprong, electrical engineer Brooklyn company, leaving here via New York Central; will arrive Erie midnight and render you any assistance possible. W. F. WELLS.

PITTSBURGH, PA., Aug. 4, 1915.

THOMAS G. O'DEA, Treasurer Erie County Electric Company, Erie, Pa.:

If you need help, will be glad to send men and material.

R. S. ORR, Duquesne Light Company.

BUFFALO, N. Y., 9.04 a. m., Aug. 4, 1915.

T. G. O'DEA, General Manager Erie County Electric Company, Erie, Pa.:

Have noticed newspaper reports of damage by storm. Can we be of any service with emergency shipments?

WESTERN ELECTRIC COMPANY.

PITTSBURGH, PA., 9.12 a. m., Aug. 4, 1915.

THOMAS O'DEA, Erie County Light Company, Erie, Pa.:

Shocked to learn of the results of yesterday's storm. Call on us for any assistance we can render.

FRICK & LINDSAY COMPANY.

NEW YORK, 12.11 p. m., Aug. 4, 1915.

THOMAS G. O'DEA, Treasurer Erie County Electric Company, Erie, Pa.:

Please call on us for any assistance we can render. Our resources in men and supplies are at your command. Please wire if we can help. N. F. BRADY,
President New York Edison Company.

NEW YORK, N. Y., Aug. 4.

CHARLES H. STRONG, President Erie County Electric Company, Erie, Pa.:

Morning papers indicate flood may have caused serious damage to your electric property. If you can use our organizations in restoring normal condition or in securing immediate shipment of material or apparatus, we will respond promptly. H. J. DOUDS,
The J. G. White Engineering Corporation.

Before the accident the French Street station had the distinction of giving uninterrupted service for twenty-seven years.

Western Water-Power Conference

As the result of a resolution passed by the Oregon Legislature last spring, there will be held in Portland, Sept. 21, 22 and 23, a water-power conference. The resolution empowered the Governor of Oregon to send invitations to various Western States to participate in the conference and requested that the delegates be named.

Perhaps no other States in the Union are so vitally interested in the question of water-power legislation as are Oregon, Washington and Idaho. A very considerable portion of the streams capable of hydroelectric power development are situated on federal lands of various sorts, and the question of a fuller utilization of these streams has been a vital one to the two or three Pacific Northwest States. It is hoped that the conference which will be held in Portland next month will bring to a focus various thoughts on the subject of water-power legislation that may result in putting the matter up to Congress in such a way that some definite results may be secured at the coming session of the national body.

The extent to which the federal government is interested in this matter may be more forcibly shown when it is brought to mind that more than 60 per cent of the State of Oregon is under federal control, either in national forests, Indian reservations, water-power withdrawals, unappropriated lands, or other lands of a similar nature. This means that considerably more than half of the State pays no taxes and the taxpayers and landowners of less than 40 per cent of the State maintain the expenses of government. This condition of affairs applies to a large extent in Washington and Idaho, but the exact percentage is not known. These facts, together with the undeveloped conditions of Northwest water-powers, are largely responsible for the passage by the Oregon Legislature of the resolution above referred to.

Early in the summer Governor Withycombe of Oregon issued invitations to the various Western States to participate in the convention, and up to the present time Washington, Idaho, Utah, Wyoming, Nevada, North Dakota, Colorado and California have accepted the invitation to participate, and Arizona, New Mexico and South Dakota have said that they were sufficiently interested in the matter to give it further consideration. Delegates have been appointed by practically all the States above mentioned. Oregon will be represented by Mr. W. Lair Thompson, an attorney of Lakeview and president of the Oregon State Senate; Mr. Edgar B. Piper, editor of the Portland *Oregonian;* Mr. S. B. Houston,

an attorney of Portland, and Mr. C. S. Hudson of Bend, together with Governor Withycombe. The delegates from the State of Washington are Mr. A. H. Imas of Kalama, Mr. W. V. Wells of Anacortes, Mr. M. C. Harris of Hoquiam, Mr. Phil H. Adams of Ellensburg, and Governor Lister of Olympia.

During the month of May there was held in Seattle a conference of Western governors, and one of the points brought up was the development of water-powers. The meeting was addressed by Mr. Henry J. Pierce, formerly of Spokane and now of Seattle, who has devoted considerable time and interest to the question and is well known in the electrical and irrigation industry of the Pacific Northwest. Mr. Pierce called attention to the condition of water-power legislation, showing the terms and provisions of the Ferris public-domain water-power bill as passed by the House and subsequently amended by the committee in the Senate. Mr. Pierce also called attention to what he considered to be unworkable features of this bill and explained how, in his opinion, they should be eliminated. He mentioned the fact that the Geological Survey estimates an available amount of 61,678,000 hp. in the United States, of which more than 44,000,000 hp. is situated in the Western States. Of the total amount in the United States, approximately 10 per cent has been developed. As a result of Mr. Pierce's presentation of the situation, the Western conference of Governors agreed to postpone further consideration of the matter of water-power legislation, with the idea that it should have full attention at the September water-power conference.

In order that the people of the State of Oregon might understand fully the underlying economic principles of water-power development, Mr. Guy W. Talbot, president of the Pacific Power & Light Company of Portland, prepared an extensive article which was published in the July *Oregon Voter*. Mr. Talbot's article was in direct reply to statements made by ex-Governor Oswald West of Oregon, in which he criticised the activities of the power companies. Mr. Talbot called attention to the unworkable features of the Ferris bill as they now stand and discussed the general theory of federal taxation of water-powers, which would result in the powers situated on the federal domain being discriminated against in favor of powers now operating on private domain. Mr. Talbot also pointed out the fallacy of there being a water-power monopoly, and showed the physical impossibility of such a condition of affairs.

At the present time plans are being perfected for the water-power conference, and as soon as the program has been completed it will be announced in these columns.

Aero-Torpedo Controlled by Radio Impulses

Rear Admiral Bradley A. Fiske, United States Navy, now attached to the Naval War College at Newport and recently aide for operations at the Navy Department, is the inventor of an aerial torpedo boat similar to that said to be under investigation by Germany. Admiral Fiske obtained patents on a method of radio control of torpedoes in 1900. His application for patent says:

"My invention is especially applicable to automobile torpedoes and makes it possible to control the movements of a torpedo with great certainty from a shore, from the deck of a ship, or from a lake."

The Navy Department contemplates the equipment for experimental purposes of a monster aeroplane, similar to a number under construction in this country for the British government, with a regulation torpedo of Whitehead type and with Admiral Fiske's device for radio control.

Executive Committee of N. E. L. A. Accounting Section Meets

The executive committee of the newly formed Accounting Section of the National Electric Light Association met to organize the work of the section at Chicago, Aug. 10, 1915. Those present were Messrs. H. M. Edwards of New York, chairman; J. H. Gulick, Chicago; L. M. Wallace, Boston; Paul R. Jones, New York, and R. W. Symes, Detroit. Mr. Frederick Schmidt, Fifteenth Street and Irving Place, New York, was appointed assistant secretary of the Accounting Section.

A resolution was passed stating that the action of the executive committee of the main association in applying for representation in the National Association of Railway Commissioners will afford, in the opinion of the section, an opportunity for discussing the advantages of a national system of accounts for electric utilities with those interested, and therefore meets with the hearty concurrence of the section.

A resolution was passed urging State or geographical sections of the N. E. L. A. to adopt the association's standard classification of accounts, so as to promote the movement for uniformity.

Standing committees were appointed or considered as follows:

Membership committee—Messrs. E. J. Allegaert, Public Service Corporation of New Jersey, chairman, and Frederick Schmidt, New York Edison Company.

Committee on uniform classification of accounts—Messrs. William Schmidt, Jr., Consolidated Gas, Electric Light & Power Company of Baltimore, chairman; C. S. Mitchell, Pittsburgh; D. A. White, Cambridge (Mass.) Electric Light Company; J. C. Van Duyne, Edison Electric Illuminating Company, Brooklyn; C. E. Murray, Toledo Railways & Light Company; Edward Horry, Edison Sault Electric Company, Sault Ste. Marie, Mich.; a member from the Pacific Coast; H. E. Addenbrooke, Commonwealth Edison Company, Chicago.

Question Box committee—Messrs. Edwin A. Barrows, Narragansett Electric Light Company, Providence, R. I.; D. R. Malone, New York & Queens Electric Light & Power Company; W. J. Achelpohl, Illinois Traction System; two members to be nominated by respectively C. E. Calder, Dallas, Tex., and R. H. Ballard, Los Angeles, Cal.

Library committee—Messrs. Alex. Holme, New York Edison Company, chairman, and representatives from the Westchester Lighting Company and the Edison Electric Illuminating Company, Brooklyn.

Cost accounting and statistics committee—Messrs. E. C. Long, Philadelphia Electric Company, chairman; Forest P. Dexter, Puget Sound Traction, Light & Power Company; A. D. Spencer, Detroit Edison Company; F. J. Boehm, Union Light & Power Company, St. Louis, Mo.; T. J. Walsh, Commonwealth Edison Company, Chicago; George Matthews, Danbury & Bethel Gas & Electric Light Company, Danbury, Conn.; a member from the Technical Section to be named by President Lloyd.

Taxation committee—If the chairman of the committee of the main association on taxation matters so desires, the chairman of the Accounting Section is authorized to appoint a committee on taxation to act in conjunction with and under the direction of the similar committee of the main association.

Committee on form of annual report—C. H. Hodskinson, Edison Electric Illuminating Company, Boston, chairman; R. W. Waite, Middle West Utilities Company, Chicago; H. R. Kern, Philadelphia Electric Company; a member from the United Electric Light & Power Company, New York; C. E. Foster, St. Joe Railway & Lighting Company; H. R. Frost, Minneapolis General Elec-

tric Company; a member to be nominated by Mr. Ballard of Los Angeles.

Committee on purchasing and storeroom accounting —Messrs. H. F. Frasse, Edison Illuminating Company, Brooklyn; W. F. Stevens, Edison Electric Illuminating Company, Boston; K. C. Campbell, Detroit Edison Company; C. Marden, Commonwealth Edison Company, Chicago; H. R. Cranford, Empire District Electric Company, Joplin, Mo.; two members to be nominated by respectively Mr. Calder, Dallas, Tex., and Mr. Ballard, Los Angeles.

Committee on customers' records—Messrs. E. J. Fowler, Commonwealth Edison Company, Chicago; H. C. Schlegel, New York Edison Company; Harry T. Hughes, Denver Gas & Electric Company, and five members to be nominated by respectively Messrs. R. W. Symes, Detroit; J. L. Bailey, Baltimore; R. H. Ballard, Los Angeles; C. E. Calder, Dallas, and L. M. Wallace, Boston.

The function of the Question Box committee will be to see that the various queries appearing in the association *Bulletin* are answered. The committee is to invite questions on the part of inquiring members and if possible it should obtain copies of all correspondence between companies and commissions in regard to the interpretations of the uniform system of accounts and embody all such matters in the annual report. The function of the committee on classification of accounts is to devise a system of accounting adapted to the needs of the business, and the function of the Question Box is to interpret such classification to the members.

The committee on form of annual report is to collect the forms of reports required by the various federal and State regulating bodies, to make a comparison between the standard classification of accounts of the association and the classification of accounts as adopted by the federal and State regulating bodies, to point out the differences appearing as a result of such comparisons between the association standard and the governmental classifications and also between the various governmental classifications, and to make suggestions as to how the differences may be eliminated.

Conference of Utilities Bureau on Valuation

Under the auspices of the Utilities Bureau a valuation conference on principles and methods used in the valuation of public utilities will be held in Philadelphia on Nov. 10 to 13. Among those who will take part are Messrs. Milo R. Maltbie, Clifford Thorne, John M. Eshleman, Charles A. Prouty, Edward W. Bemis, Delos F. Wilcox, John H. Gray and Max Thelen.

Volume 1, No. 1, of the *Utilities Magazine* has been issued. It is stated to be "one medium through which the Utilities Bureau will give to officials and city residents information of interest and usefulness in utility matters." The bureau, of which Mr. Morris Llewellyn Cooke of Philadelphia is acting director, was founded at the meeting of mayors of cities in Philadelphia in November, 1914. The introductory article states that through the magazine the bureau will endeavor in part to fulfill its functions as a central agency.

Among the articles are those on "The Right of a Plaintiff to Examine the Books and Properties of a Utility Company," by Mr. Harold Evans; "Public Utility Problems and the Municipality," by Mayor Ira W. Stratton of Reading, Pa.; an abstract of the decision of the New York Public Service Commission, First District, in the case of Stadtlander et al. versus the New York Edison Company, with an introduction by Mr. Cooke, and "Pasadena's Municipal Light Plant," by Mr. C. W. Koiner.

The Naval Advisory Board

The Inventors' Guild has selected two members for recommendation to Secretary Daniels for membership on the Naval Advisory Board, but public announcement of their names has not been made.

Mr. Thomas Robins, secretary of the Inventors' Guild, made the following statement to the ELECTRICAL WORLD:

"To paraphrase a letter which I have just sent to our president, Dr. Edward Weston, I may say that, while the Inventors' Guild is of course not responsible for the entire composition of the board, our duty being limited to the selection of two members, we feel that as inventors we should at least employ our imaginations in an effort to picture the functions of this advisory board and, having done this, to select the two men who would be the best for the particular work that is to be performed.

"It seems to me that, as Mr. Frank J. Sprague has pointed out, the duties of the board are to be advisory. Therefore, it must be in a position to give unprejudiced advice as to schemes and devices of all kinds which are submitted to it. It may safely be assumed that there will be enough suggestions submitted from the outside to occupy fully the attention of the advisory board, and it follows that if the board is to give impartial criticism it should deal only with matters which do not originate with any member of the board.

"If, on the other hand, instead of choosing men for their sound judgment combined with broad technical experience, the board is composed mainly of men who have solely inventive or scientific ability, I can foresee a great deal of discussion and very little being done. Each member would naturally be inclined to favor some special scheme of his own and would be wrapped up in it to such an extent as to make valueless his opinion concerning the suggestions of the other members. That mental attitude is characteristic of the pure inventor; concentration is often the secret of his success. Great inventions and the most valuable research work are the result of solitary, closeted effort. If this Naval Advisory Board were to be composed exclusively or mainly of pure scientists and men noted only for their inventions, it could reach its maximum efficiency only by an immediate scattering of the members to their eighteen respective laboratories, and if a quorum were ever obtained it would mean the serious interruption of valuable work.

"Therefore it would seem that, if the board is to work effectively, all its members should be barred from inventing, except incidentally, and from doing any personal research work. Its usefulness will lie rather in having the knowledge how and by whom such detailed work and investigation can best be done, in supervising such work in a general way, and in giving an unprejudiced judgment of the result.

"It is to be expected that the board will be divided into various committees, and that each member will be consulted about the particular branch of science or engineering with which he is especially familiar.

Broad and Successful Business Qualifications

"It therefore seems that broad and general acquaintance with some great branch of science would be more valuable than more profound knowledge along a narrower line. The members of the board should have inventive ability only because they will need sufficient imagination to appreciate the inventions of others. It should be an incidental qualification and clearly secondary to mature experience in passing upon inventions and in finding the men and methods for their successful development.

"I certainly do not wish to belittle the importance of some of our greatest men, but it seems to me that un-

less an inventor or scientist has also had a broad and successful business experience in an executive capacity he will be more valuable off the board than on it. I think that this point is proved by the following test question: If you, for example, were desirous of obtaining for your company the most valuable possible improvement or discovery in your own department of science, would you assign to the task of hunting up this invention the man who had already made the greatest invention in your particular line, or would you leave it to the most competent executive in your business? I think you would consider the inventor as too hidebound for such a job, and perhaps too jealous of his own inventions, and that you would prefer to employ for the work a man who knew every technician in your line and had already passed upon and tried out, without personal bias, hundreds of schemes and experiments.

"It has been suggested that the chemical societies will provide members who will be fitted for research work. That seems to be a wrong idea for the reasons stated. It has also been suggested that the American Institute of Electrical Engineers propose two men skilled as designers and connected with the large companies. It would seem to be more logical to choose the presidents or general managers of these companies and let them later call upon their designers when this help is needed. It has also been urged that men of executive experience would have no place on the board. In that event from whom would the board obtain the skilled judgment required in passing upon the numberless ideas that will be presented, and which of its members will have general knowledge as to where expert and special assistance can be procured?

"Let us have scientists by all means, but broad ones. If every man of the eighteen is broad enough, there will be no able inventor or expert scientist in the country unreached by the long arm of their experience.

"We ought to do what we can to prevent a fiasco and to bring about the formation of a Naval Advisory Board that will be worthy of its opportunities and justify the work that has already been done in connection with it by our two members, Mr. Edison and Mr. Sprague."

Selections of Aeronautic Engineers

The American Society of Aeronautic Engineers has named Messrs. Henry A. Wise Wood and Elmer A. Sperry as its appointees for the Naval Advisory Board.

Light as an Advertising Medium

"A Novel Use of Light as an Advertising Medium" was the subject of an informal talk and demonstration by Mr. A. L. Powell of the Edison Lamp Works before the eighteenth annual convention of the International Association of Display Men at the Waldorf-Astoria Hotel, New York, on Aug. 5, 1915. The speaker pointed out the similarity between the work of the display men and that of the stage manager, but said that while the latter appeals to his audience through two senses, sight and hearing, the display manager has only one means of attracting attention, that is, through the eye. Accordingly, light is his most valuable agent.

The improvement in color, value and specific consumption of incandescent illuminants was shown by typical lamps, including a lamp made in Mr. Edison's laboratory in 1880 and the latest gas-filled tungsten-filament lamp with a special blue globe for approximating daylight color. By means of a color triangle of electric lamps and reflectors, Mr. Powell demonstrated how the three primary colors, red, green and blue, united to form a white light, and how the other colors were produced by the mixing of these three.

The startling effects which it is possible to produce through a variation of the color and direction of light on pictures, merchandise, statuary and the like were brought out clearly with the aid of a specially designed cabinet or booth. In summing up, the speaker explained that his object was not so much to demonstrate the physical effect of light on objects as to sow the seeds of a new idea in the minds of his audience. In brief, colored and directed light, properly applied, is a valuable means of attracting attention. Its use is novel and its effect is startling, and the results can be produced by simple apparatus.

Proposal to Dam the Niagara Gorge

A plan to develop 2,000,000 hp. by damming the lower Niagara River just above Queenston, Ontario, and Lewiston, N. Y., has been presented to the New York State authorities. The proposal, which is made by Mr. Peter A. Porter, who introduced the original power development bill in the New York State Legislature in 1886, calls for the expenditure of $100,000,000. In this amount is included damages to the Gorge Route.

It is proposed to construct a dam about 90 ft. high, which, while it would wipe out the famous whirlpool rapids, would not interfere with present developments near the cataract. A junior Niagara would be created in the gorge by the proposed dam, which would be about one-third of the height of the gorge bank. The drop of the river from the falls to Lewiston is 100 ft., and the proposed dam would back up the water to within a mile of the falls. It is claimed that the creation of a new falls at Queenston will compensate for the loss of the rapids. About 1,000,000 hp. will be available to New York State and a like amount to the Province of Ontario. It is suggested that by imposing a tax of $5 per hp. developed a maximum of $5,000,000 would be derived yearly by each government.

New Orleans Company to Reduce Rates

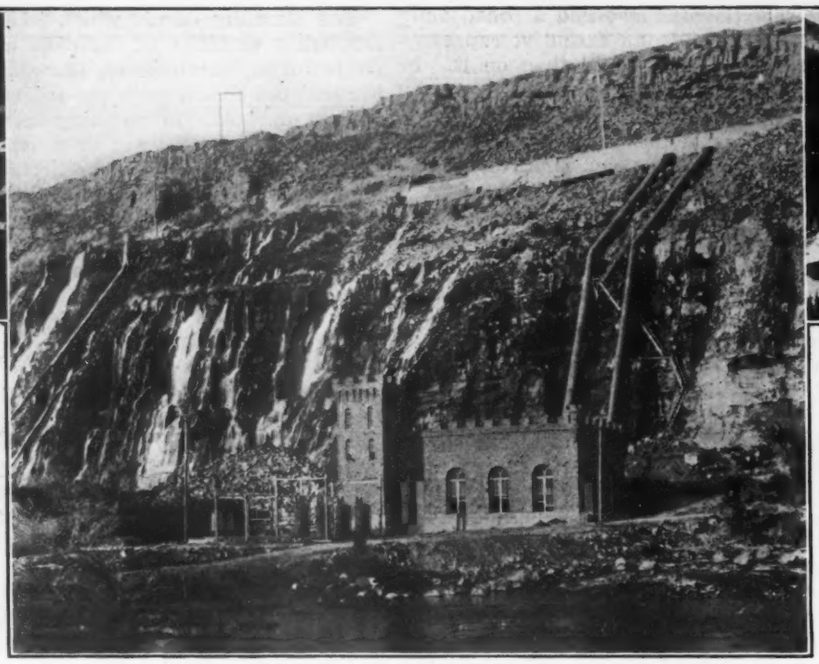
Mr. D. D. Curran, president of the New Orleans Railway & Light Company, has written to the Commission Council of New Orleans announcing that a reduction in rates will be made. Mr. Curran said that rates recommended by the Council would not allow a fair return on the value of the property. He added:

"The New Orleans Railway & Light Company realizes fully that the best interests of New Orleans and the best interests of the company are identical; that the prosperity of one spells the prosperity of the other, and that which unjustly cripples or injures either has its reflex in a like loss and detriment to the other.

"The company has considered Commissioner Lafaye's compilation of rates with an open mind and without bias. The rates suggested by Mr. Lafaye and concurred in by your honorable body cannot be agreed to by this company, and our declination is the result of a definite conviction by the officers and directors that Mr. Lafaye's rate suggestions are not reasonable and would be destructive to the company.

"In spite of the conditions as above outlined and notwithstanding the unpropitious times, the company one year ago indicated to Mr. Lafaye that it was perfectly willing to make such reductions as would establish a schedule of rates that would at all times give to New Orleans a rate schedule as favorable as that enjoyed by any other community in a comparatively like situation, and which would be eminently fair to its patrons, because it realizes the great value of having the hearty support and good will of the citizens whom it serves and at all times desires to please."

PROSPECTING FOR THE "WHITE COAL" OF THE MOUNTAINS OF THE NORTHWEST



The Thousand Springs Plant in Idaho. Here a Great Underground River, After Flowing for Miles Beneath the State-Wide Bed of Lava, Gushes to Daylight from the Fissure Between Basalt and Bedrock

FOREST-CLAD HILLS ARE NATURE'S RESERVOIRS OF WATER-POWER

Where the Subterranean Waters Once Plunged in a Thousand or More Springs to the Snake River, 175 Ft. Below, Now, Harnessed by Penstock and Turbine, They Serve to Light and Furnish Power to Distant Towns and Cities

Federal and State Control of Water-Power

Co-operation Between the States and the National Government in the Allotment of Water Rights in California and Oregon

By Leonard Lundgren*

MUCH has been said along theoretical lines about the dual control of water-powers in the United States between federal government and sovereign States, one arising from the ownership of public lands and the other from State laws on the appropriation of water. Many writers have attempted to point out that such control is incompatible with the industrial development of the country and actually hinders its growth. In actual practice, however, the federal government works in the closest harmony with the State. The regulations of the Secretary of Agriculture, effective on Feb. 1, 1915, contain the following:

"Wherever the approval of a State administrative official, board or commission is a condition precedent to the right either to take and use water for power purposes or to engage in the business of the generation, transmission or distribution of power, certified evidence of such approval must be filed . . . before a final permit will be issued. Formal notification by such official, board or commission that the water right has been canceled or the permission to engage in the power business withdrawn will be deemed sufficient grounds for the revocation of the permit."

This or a similar requirement has been in force in the regulations of the Departments of the Interior and Agriculture for five years. During this period no person has secured a permit to construct a water-power plant on public lands without first securing a water right from the State. Recently, in order to facilitate the approval of applications for water-power both by the State and the federal government, a co-operative agreement was entered into between the State Water Commission of California and the Secretary of Agriculture. This provides in substance as follows:

Co-operative Agreement with California

Whenever an application for a preliminary or final permit for a water-power site is filed with the district forester at San Francisco, and the evidence of the appropriation of water consists of a notice posted in conformity with the civil code of California, immediate notice of such application shall be sent to the State commission. Whenever such application is filed with the district forester and the evidence of the appropriation of water consists of an application made to the State commission under the existing water-power act, it will be sufficient to inform the commission that such application has been filed.

Whenever an application is made to the State commission for a permit to appropriate water, and the use of such water will necessitate in any manner the occupancy and

THE THOUSAND SPRINGS SITE AS IT APPEARED IN 1910, BEFORE THE ERECTION OF THE PLANT

*District engineer United States Forest Service.

use of any national forest land, immediately notice shall be given to the district forester at San Francisco. No application for a water right involving the use of national forest lands will be approved by the State commission prior to notification by the district forester that a complete application for the use of the national forest lands has been filed in conformity with the regulations of the Secretary of Agriculture.

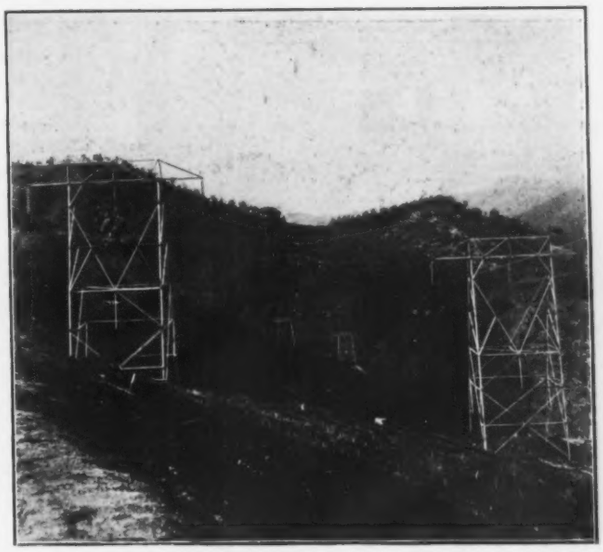
If the application filed with the district forester is for a preliminary permit, the State commission will defer final approval until notified by the district forester that a complete final application has been filed in accordance with the regulations of the Secretary of Agriculture, or that a preliminary permit containing permission to do construction work has been issued. The district forester will confer with the State commission before arranging the terms of any preliminary permit and will furnish copies of such permits immediately upon issuance.

If the evidence of the appropriation of water filed with an application for a final permit for a water-power site consists of a notice posted in conformity with the civil code of California, such permit will not be issued until the State commission either approves such appropriations or disclaims jurisdiction. If the applicant relies upon an appropriation under existing law, no final permit will be issued until notice of the approval of the commission has been filed with the district forester.

No preliminary permit will allow construction upon national forest land except in an emergency or to comply with the State law, and then only upon approval of the State commission.

If the time for beginning and completing construction under any final permit issued by the Secretary of Agriculture is different from that granted by the State commission, such difference shall not be deemed to affect in any way the permittee's liability under the State law or the approval of the commission, or to free him from the cancellation of his permit if he loses his water right under the State law.

If any permittee shall lose his water right because of failure to begin construction in accordance with the requirements of the State law and of the approval of the State commission, such loss of right when certified to by the commission shall be deemed sufficient cause for revocation of the permit.



TRANSMITTING THE POWER OF A WATERFALL 240 MILES AT 150,000 VOLTS

If either the district forester or the State commission shall fail to give notification of any action as contemplated herein within sixty days of the receipt of written report of applications pending, the officer or office so reporting may take action without waiting further for such notification.

Experience of One Company

The effectiveness of an agreement of this kind is well illustrated in a letter written to one company by the Secretary of Agriculture. This letter says in part:

"It appears that the company filed in the office of the district forester at San Francisco an application for rights-of-way for dams, reservoirs, water conduits, power houses and transmission lines, comprehending a development of five power projects on a creek in the Inyo National Forest, California. The application so presented was complete with the exception of a permit from the State Water Commission. It appears also that the company made application to the State commission for approval of its appropriation of waters from the creek

A DESERT NIAGARA—DESTINED SOME DAY, PERHAPS, TO BECOME A WESTERN CENTER OF WATER-POWER-DRIVEN INDUSTRIES AND ELECTROCHEMICAL MANUFACTURES

HUGE OIL SWITCHES CONTROL THE HIGH-POTENTIAL ENERGY AS IT LEAVES THE POWER HOUSE

for the purposes of the proposed power development, but that such application was rejected because the commission 'believed that the public interest so demanded.'

"On account of the incompleteness of the application as required by the regulation of this department, the district forester held the company's application for rejection and allowed it sixty days within which to appeal, if it so desired. This appeal has been taken and the company asks that its application be reinstated for action upon its merits on the ground that the provision of the regulations should not be construed as applying to the national forests, because the administration and control of water of non-navigable streams within national forests for hydroelectric power development rests solely in the government of the United States, and the State of California cannot, without the consent of Congress, 'enact any valid law regulating the appropriation of the waters of national forests for power purposes.'

"The regulations were adopted chiefly in order that the department and the States might co-operate, as far as practicable, in the administration of water-power development in the national forests. The regulations were adopted with full appreciation of the legal questions which are involved in the appropriation and use of waters on the reserved lands of the United States and without any purpose, express or implied, to relinquish any rights which the United States may have in and to the waters in the national forests. It is believed that better results can be secured under existing conditions by co-operative action between the State and federal authorities than by any insistence upon strict legal rights on behalf of either.

"Since the regulations have been adopted for administrative reasons and cannot be held to express, in any degree, the views of this department with respect to the legal rights of the United States in the unappropriated waters of navigable streams in national forests, or to be a waiver of any rights therein that the United States may possess, no reason is perceived why the department should in this case waive or modify the requirements of these regulations. The action of the forester in rejecting the application of the company is sustained."

This letter can leave no doubt of its intent in the mind of the reader. It shows that the United States is not assuming the exercise of any function of the sovereign State. Whatever right of control over water-power sites the federal government may have through ownership of public lands, the administration of such sites is being used to supplement the efforts of the State to conserve its natural resources. A similar co-operative agreement has also been entered into with the State of Oregon, which still further illustrates this principle. The preamble states the purposes to be accomplished: "In order to insure co-operation and uniform action, to avoid duplication of work and expense, to make available to both the data secured and action taken by each, and to facilitate the approval of application for water rights for the use and occupancy of national forest lands within the State of Oregon for the development of water-power."

It is anticipated that other States having laws which permit co-operation, as outlined above, will see the advantages that will accrue to all parties concerned and will accordingly enter into similar agreements.

It has been the aim of this article to show that co-operative control over public lands and public waters can be and is being exercised in complete harmony by the State and national governments, to their mutual advantage and without the surrender of any rights which either may possess.

Electric Trucks for Boston Mail Service

Plans have been perfected at Boston, Mass., for the inauguration of mail service by electric trucks on Aug. 15 under a two-year contract between the Post Office Department and the Boston Mail Delivery Company. The new service will be handled by fifteen 1.5-ton General Vehicle trucks equipped with forty-four-cell "MV Ironclad Exide" batteries, the machines being operated on the "battery-service" plan lately put into effect by the Edison Electric Illuminating Company of Boston and previously tried at Hartford, Conn. It is anticipated that the trucks will be in operation practically all the time, returning to the Atlantic Avenue garage of the Edison company for a change of batteries whenever necessary. At present much of the mail between the Federal building and the suburban stations of the Boston Postal District is transported in special mail cars operated by the Boston Elevated Railway, and in addition a large amount of horse trucking is in operation between the railroad terminals and the main Boston post office.

The longest run, including stops, in the new electric-truck schedule will be 23.5 miles round trip from the Boston post office, and many outlying post offices in the metropolitan district will reap the benefit of the new service. With the electric-truck service it is expected that substantial savings in rehandling of mails at the main office in Boston will result, as it is at present not feasible to operate trolley mail cars through the teaming passage which cuts through the basement from Water to Milk Street.

Arrangements for the service were completed last week by Postmaster Murray, Superintendent of Mails Countie and Vice-president James J. Cassidy of the delivery company. Mr. Cassidy stated in an interview that the machines to be used at Boston will be similar to those used in New York City. Mr. Cassidy said further that he hoped to expedite deliveries at Boston, and that in New York newspaper publishers had found that the service saved about one hour over former conditions. It is anticipated that at least forty-five minutes will be cut from Boston delivery times, and it is expected that many suburban stations which at present experience delays in the delivery of the morning mails from New York will be much benefited by the new arrangement. The headquarters of the delivery company are in the Tremont Building, Boston.

What to Call Alternating-Current Motors

At the annual convention of the American Institute of Electrical Engineers, held at Deer Park, Md., June 29 to July 3, two important papers relating to the classification of dynamo-electric machinery were presented for discussion as the result of requests made by the standards committee of the Institute to serve as the basis for the selection of satisfactory and acceptable nomenclature relating especially to alternating-current commutator motors. In view of the fact that the papers referred to—namely, one by Mr. Val A. Fynn and one by Mr. F. Creedy—have not as yet been discussed fully by even a small number of the persons vitally interested in the work of the standards committee, and in conformity with the desires of the officers of this committee, the columns of the ELECTRICAL WORLD have been opened to present for the benefit of the whole electrical industry the views of those willing to take part in the discussion. It is believed that in this manner the standards committee will be able to obtain a true consensus of opinion that will be of inestimable value in the work with alternating-current commutator motors.

There are presented below an introductory communication from Prof. Comfort A. Adams, secretary of the A. I. E. E. standards committee, and comments from Prof. Elihu Thomson and Mr. E. F. W. Alexanderson, who have consented to open the discussion in these columns.

THIS communication is meant to introduce, rather than to be a part of, the discussion on alternating-current commutator-motor classification and nomenclature, and beyond a brief historical statement its purpose is to emphasize (a) the importance of the subject of nomenclature, and (b) the difficulties in the way.

More than a year ago the A. I. E. E. sub-committee on nomenclature was faced with the necessity of revising the nomenclature of alternating-current commutator-motors to meet, at least in part, the enormous growth in variety of these machines. But there were great differences in usage and radical differences of opinion as to the general principles which should form the basis of a suitable nomenclature and classification. It seemed wise, therefore, to open the subject to the widest possible discussion, international as well as national, and not to put forth any definitions within this field till there was a reasonable prospect of their being acceptable to and adopted by the majority of those interested.

To this end papers were invited from several authorities on the subject. As a result, two papers, by Messrs. Fynn and Creedy, were presented at the annual convention at Deer Park, Md., on July 1, 1915. Unfortunately only a few of those most interested were present at the convention, so that the opening of these columns to this discussion is very acceptable to the standards committee.

The principal distinction between man and the other animals is in the use of words, and accuracy in the use of words is in some degree a measure of civilization. But the work of the standardization of nomenclature is not only in the interest of accuracy, it is largely in the interest of efficiency. It is almost always possible to explain a technical point in a new field to an intelligent listener, provided there is no time limit; but it usually involves a considerable exposition of one's own language, whether of words, of diagrams, of symbols, or of any combination thereof.

It is thus of the greatest importance that our technical terms and symbols be of unquestionable meaning, and that we be not obliged to learn three or four names for the same machine. We are so accustomed to this latter state of affairs that we hardly realize what an enormous waste of time and effort is involved. As in the case of our double system of units, the waste is impressed perhaps more keenly upon the attention of the teacher than upon that of other members of the engineering profession. When the inherent difficulties in the understanding of a subject are quite sufficient to tax to the utmost the mental capacity of the average student, it is a criminal waste of possibilities to add the confusion of an indefinite multiple nomenclature and a mixed double system of units. In many cases the cost is the real understanding of the subject. But, apart from the educational side, there remains the commercial side of the subject, with its important bearings on contracts, specifications and patents.

However, accuracy in the use of words implies not only accuracy in their definition, but also that their definitions be generally accepted and understood. If one does not choose to use commonly accepted terms, but manufactures a language of his own, he may be ever so consistent in the use of his language, but he will not be successful in conveying his ideas accurately to others unless he is able to persuade those others to learn his language. Fortunately or unfortunately, there is no individual or small group of individuals so influential as to be able to force the general acceptance of a single word or term against established usage, even when the usage extends throughout only a single professional group such as that of the electrical engineers, and even when the new term is more scientifically descriptive and more rational than the established one. A striking illustration of this fact, in the experience of the standards committee, was the very unsuccessful attempt to substitute the descriptive term "synchronous phase modifier" for the unscientific term "rotary condenser." Even the term "synchronous converter," for many years in the standardization rules, has made slow progress except in official circles, the older term "rotary converter," or simply "rotary," being still largely in use, and this in spite of the fact that most of the technical books have supported the position taken by the standards committee on this point.

Thus, although the standardization rules are assumed to be authoritative on most of such questions, their influence upon the usage of technical terms is decidedly limited and dependent upon the co-operation of editors, authors, manufacturing companies, and the leading engineers in the particular field concerned.

As a result of the discussion started by the two papers above mentioned, the standards committee hopes to secure a rational system of classification for alternating-current commutator motors and a scientifically descriptive nomenclature, but it realizes that the first requisite of any such system is that it be generally acceptable and sufficiently advertised to be quickly incorporated into the language of the profession.

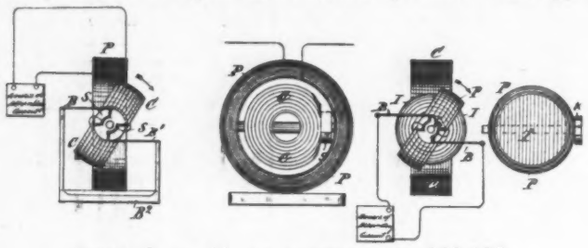
To this end it seeks the broadest possible discussion of the subject and the hearty co-operation of all those interested.

The final outcome should be on an international basis. We cannot afford to start on different tracks in a new field of this kind.

C. A. ADAMS,
Secretary Standards Committee A. I. E. E.
Cambridge, Mass.

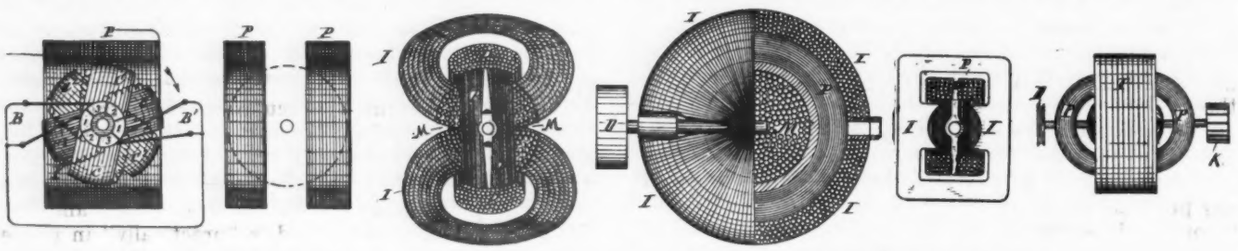
Classification Based on Structure Preferable

Before I refer to the subject of the classification of alternating-current single-phase motors and other electromagnetic machinery recently taken up in papers before the American Institute of Electrical Engineers, one by Mr. V. A. Fynn and another by Mr. F. Creedy, I



FIGS. 8 TO 11 OF PATENT NO. 363,185

desire to allude to some objections and misstatements of fact by Mr. Fynn as to the term "repulsion motor." He says: "The term 'repulsion motor' is first found in Elihu Thomson's United States patent No. 363,185 of 1887." As a matter of fact, the term is not to be found in such patent. He says further: "The form of Thomson motor as described and illustrated in that specification is shown in Fig. 48" (of his paper). This form in the patent is found in its figures 8, 9, 10 and 11 as illustrative of principle only. Why he has chosen to neglect the subsequent and more complete figures from 12 to 17 inclusive I cannot understand. Motors like Figs. 16 and 17 of the patent were built and run in 1886. These



FIGS. 12 TO 17 OF PATENT NO. 363,185, ISSUED TO ELIHU THOMSON, MAY 17, 1887

were the first alternating-current motors outside of plain series machines run on alternating current. Mr. Fynn says in his "Remarks" at the end of his paper that he "is quite sure that the machine to which it" (repulsion motor) "was first applied in 1887 does not operate by virtue of any *repulsion* effect or phenomenon as understood from the year 1820 to the present day." Quite true; not until we knew something about phase relations of induced currents to other currents was the subject opened. Reading my early patents of nearly thirty years ago attentively, anyone can see that repulsion straight away and deflection on an axis, whereby the active induced turns of a coil are removed as far as may be from the plane of the inducing coil, are the same in essence. The latter can be treated as a "repulsion" of the active parts of a coil, which thus sets itself or tends to do so at right angles to the inducing coil if constrained to move on an axis. The track or direction may be straight or curved. That is all there is to it. The final result is for the induced coil to place itself out of range of the inducing coil, and this I aver is a case of "repulsion."

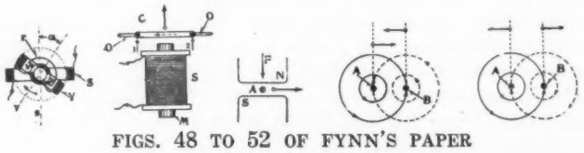
I cannot understand the viewpoint of Mr. Fynn, who seems to go out of his way to endeavor to confine the term "repulsion" to a sense never intended in the original documents, which are certainly plain enough on these points.

If I were disposed to be equally critical, I might with far more reason object to Mr. Fynn using the term "circuits" instead of parts of circuits or windings. Thus, in his title to his Fig. 7, he uses the term "motor with two conductively related rotor circuits," when he means two windings in the same circuit. So also with his titles to Figs. 8, 9 and 19. In this last figure two windings on the rotor are in one circuit. The distinctions Mr. Fynn makes on the last two pages of his paper, which concern the positions of brushes on commutators of repulsion motors, are only those long before known to exist when comparing open-coil armatures with the Gramme-Paccinoti or closed-coil windings. They were understood to exist more than thirty years ago, and in my exhibit of single-phase apparatus at the Paris Exposition of 1889 both forms of winding were shown in single-phase motors. Moreover, it was also shown that, after starting, a complete short-circuit of all the coils might be made and kept during a whole revolution in either type. One machine built in 1887 showed an open-coil rotor which by extending the covering arc of a set of connected brushes could, as the motor speeded up, finally cover the commutator segments so as to keep the coils of the rotor continuously short-circuited during their rotation.

It may be admitted that most motors work by repulsion and attraction, but the Ampère rules were made before alternating currents became a factor in engineering, and the necessity of definite phase relations was not comprehended till comparatively recent times. How far Ampère's rules are truly aside from the present matter may be understood by considering the action of one coil on another when the current phases are displaced by 90 deg. The result is coincidence of direction of currents in one part of the phase and opposition in another, which, so far as any mechanical effect of repulsion or attraction is concerned, cancel out. According to Ampère's rules we have here both attraction and repulsion, but the currents, being alternating, give no evidence of it.

I may remark in passing that while Mr. Fynn's Fig. 16 represents a simple type of so-called "repulsion motor," invented by me in 1886, other forms were not only contemplated at the time but even tried within a few months, such as that of Figs. 13 and 39 of Mr. Fynn's paper.

Without wishing to disparage in any way the excellent work of Mr. Fynn in pointing out as many as



FIGS. 48 TO 52 OF FYNN'S PAPER

forty-four motors of the single-phase type and naming them, it seems to me that in forming a classification there is a need of consistent grouping such that many of these forms become evident modifications of others. Personally I should prefer a classification based more on structure than on function, and the titles given by Mr.

Fynn to his variations seem often to be too lengthy and cumbersome, needing to be abbreviated.

I am not prepared to state how this may be done, but there is evidently considerable room for study and suggestion in this interesting and important field.

It seems to me that Mr. Creedy's paper is also highly suggestive of methods of classification which may be used conveniently. Except for interesting studies, so far as the engineer himself is concerned, he can afford to neglect types which are not used or likely to be used in practice.

West Lynn, Mass. ELIHU THOMSON.

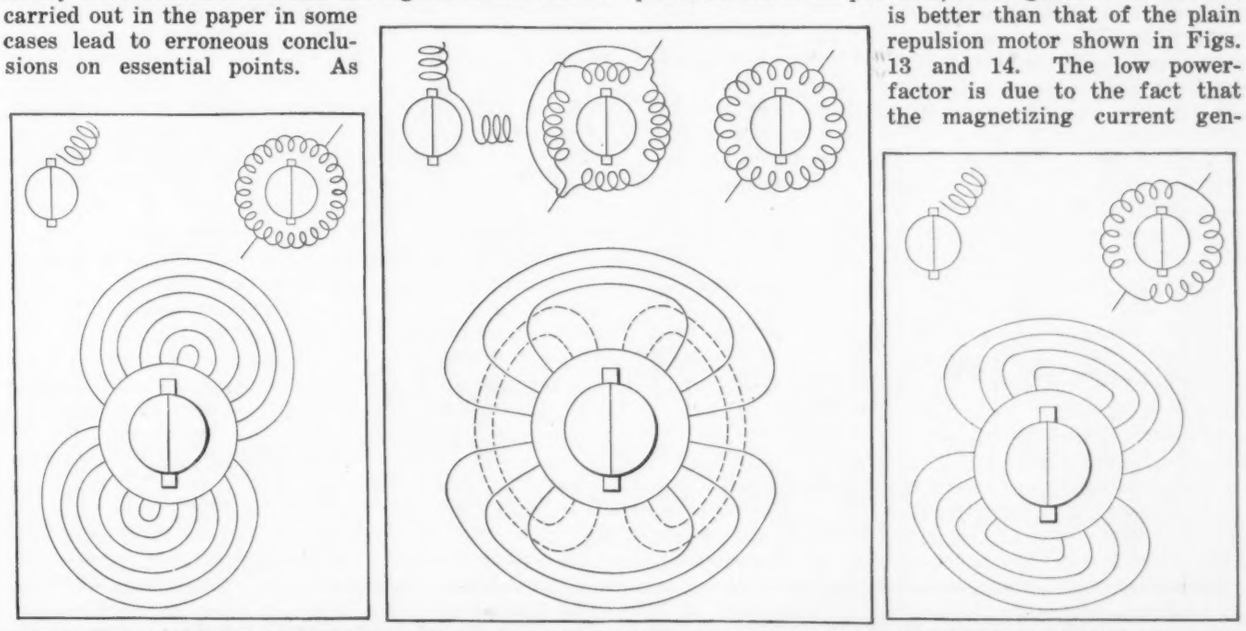
Suggested Classification Too Confusing

The A. I. E. E. paper prepared by Mr. Val A. Fynn on alternating-current motors appears to be a repetition of the several attempts that have been made to find a consistent and comprehensive method for classifying the great variety of motor types that come under this heading. I believe that Mr. Fynn's paper demonstrates the difficulty of this task, not only through the cumbersome and unpractical nomenclature that must be adopted, but through a number of errors in results and conclusions which will necessarily follow attempting such a simplification of a theory which is too complicated to be treated in that way.

Those who are interested in alternating-current commutator motors may be grouped into those who are interested in the use of such motors, those who are interested in the theory and design, and those who are interested in the rather involved patent situation. The value of a classification such as suggested by Mr. Fynn may be looked at from the point of view of these three groups of individuals. Out of these, the first group—those who are interested in the use of alternating-current commutator motors—can be dismissed without any further argument. The complication of the nomenclature is such that it would be impossible to use it for any practical purposes. Those who are interested in the theory and design of such motors might derive some benefit from a consistent classification even though it were complicated, provided the definition of the various motor types was represented by their names and the abbreviated theory accompanying it were true to facts. As a matter of fact, some of the essential parts of the theory have been left out and the logical deductions as carried out in the paper in some cases lead to erroneous conclusions on essential points. As a good illustration of this statement there may be pointed out the lucid explanation of Fig. 13, which is classified as a "self-excited single-phase series induction motor with rotor excitation," and Fig. 14, classified as a "single-phase series induction motor with stator excitation." These two motors are explained to function in a different way and have different characteristics. However, both of these figures are only different representations of the well-known single-phase repulsion motor. The difference is that in Fig. 14 the stator winding is spread over 180 electrical degrees and in Fig. 13 over a somewhat smaller angle.

If the stator winding be represented as a concentric winding, this becomes clear. If all the coils are in use, the motor conforms to diagram No. 14, and if a few of the concentric coils are removed, it becomes a motor in accordance with diagram No. 13. In both cases the axis of the stator winding is the same, and the removal of a few coils means merely that the others must carry a little more current; but this does not change the general motor characteristics except as far as local distribution of flux may affect commutation. However, on account of the difference in the method suggested for drawing the diagrams, a different theory is presented and one motor is classified as one with rotor excitation and the other as one with stator excitation. Furthermore, the first motor is classified to be self-compensating and to have a higher power-factor. This classification is erroneous, and the one motor has stator excitation in the same sense as the other on account of the somewhat greater current flowing in the stator coils. An essential part of the theory that has been left out is the fact that the armature rotates in a field and creates an electromotive force of rotation which is short-circuited, and that this short-circuited electromotive force is exchanged for a magnetizing current which then again transfers the generated electromotive force back to the stator winding. An accurate understanding of this phenomenon is necessary in order to predict the power-factor and characteristics of such a motor, and the statement that the motor field is "practically" in phase with the armature ampere-turns is therefore directly misleading.

In Fig. 20 is shown a repulsion motor where the field winding is included in the short-circuit of the armature. This motor, as a matter of fact, has too low a power-factor to be practical, although its commutation is better than that of the plain repulsion motor shown in Figs. 13 and 14. The low power-factor is due to the fact that the magnetizing current gen-



THREE TYPICAL WINDING DIAGRAMS OF PLAIN REPULSION MOTORS WITH EQUIVALENT DIAGRAMMATIC REPRESENTATIONS

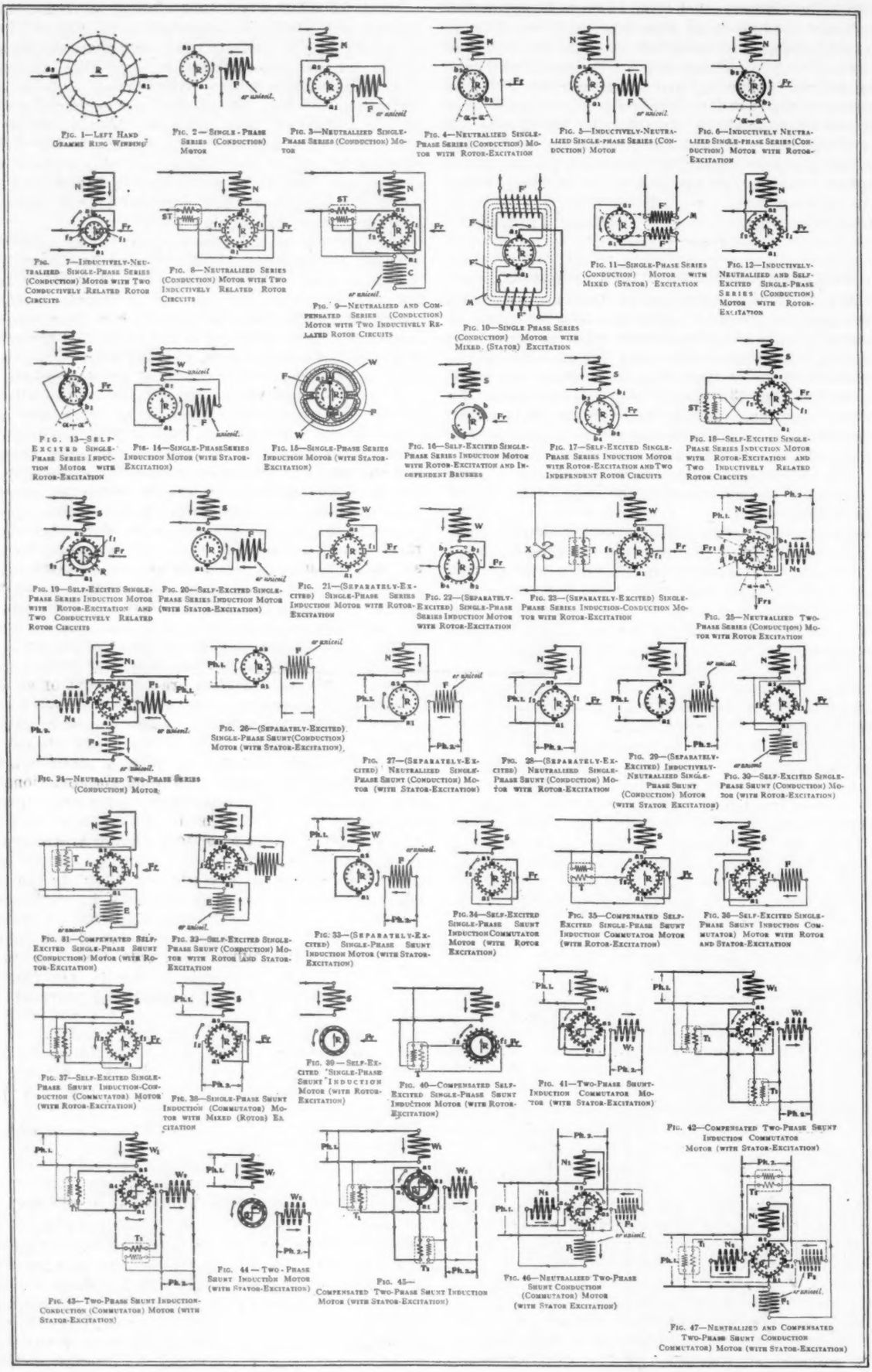


FIG. 1—LEFT HAND GRAMME RING WINDING

FIG. 2—SINGLE-PHASE SERIES (CONDUCTION) MOTOR

FIG. 3—NEUTRALIZED SINGLE-PHASE SERIES (CONDUCTION) MOTOR

FIG. 4—NEUTRALIZED SINGLE-PHASE SERIES (CONDUCTION) MOTOR WITH ROTOR-EXCITATION

FIG. 5—INDUCTIVELY-NEUTRALIZED SINGLE-PHASE SERIES (CONDUCTION) MOTOR

FIG. 6—INDUCTIVELY NEUTRALIZED SINGLE-PHASE SERIES (CONDUCTION) MOTOR WITH ROTOR-EXCITATION

FIG. 7—INDUCTIVELY-NEUTRALIZED SINGLE-PHASE SERIES (CONDUCTION) MOTOR WITH TWO CONDUCTIVELY RELATED ROTOR CIRCUITS

FIG. 8—NEUTRALIZED SERIES (CONDUCTION) MOTOR WITH TWO INDUCTIVELY RELATED ROTOR CIRCUITS

FIG. 9—NEUTRALIZED AND COMPENSATED SERIES (CONDUCTION) MOTOR WITH TWO INDUCTIVELY RELATED ROTOR CIRCUITS

FIG. 10—SINGLE PHASE SERIES (CONDUCTION) MOTOR WITH MIXED (STATOR) EXCITATION

FIG. 11—SINGLE-PHASE SERIES (CONDUCTION) MOTOR WITH MIXED (STATOR) EXCITATION

FIG. 12—INDUCTIVELY-NEUTRALIZED AND SELF-EXCITED SINGLE-PHASE SERIES (CONDUCTION) MOTOR WITH ROTOR-EXCITATION

FIG. 13—SELF-EXCITED SINGLE-PHASE SERIES INDUCTION MOTOR WITH ROTOR-EXCITATION

FIG. 14—SINGLE-PHASE SERIES INDUCTION MOTOR (WITH STATOR-EXCITATION)

FIG. 15—SINGLE-PHASE SERIES INDUCTION MOTOR (WITH STATOR-EXCITATION)

FIG. 16—SELF-EXCITED SINGLE-PHASE SERIES INDUCTION MOTOR WITH ROTOR-EXCITATION AND INDEPENDENT BRUSHES

FIG. 17—SELF-EXCITED SINGLE-PHASE SERIES INDUCTION MOTOR WITH ROTOR-EXCITATION AND TWO INDEPENDENT ROTOR CIRCUITS

FIG. 18—SELF-EXCITED SINGLE-PHASE SERIES INDUCTION MOTOR WITH ROTOR-EXCITATION AND TWO INDUCTIVELY RELATED ROTOR CIRCUITS

FIG. 19—SELF-EXCITED SINGLE-PHASE SERIES INDUCTION MOTOR WITH ROTOR-EXCITATION AND TWO CONDUCTIVELY RELATED ROTOR CIRCUITS

FIG. 20—SELF-EXCITED SINGLE-PHASE SERIES INDUCTION MOTOR (WITH STATOR-EXCITATION)

FIG. 21—(SEPARATELY-EXCITED) SINGLE-PHASE SERIES INDUCTION MOTOR WITH ROTOR-EXCITATION

FIG. 22—(SEPARATELY-EXCITED) SINGLE-PHASE SERIES INDUCTION MOTOR WITH ROTOR-EXCITATION

FIG. 23—(SEPARATELY-EXCITED) SINGLE-PHASE SERIES INDUCTION-CONDUCTION MOTOR WITH ROTOR-EXCITATION

FIG. 25—NEUTRALIZED TWO-PHASE SERIES (CONDUCTION) MOTOR WITH ROTOR EXCITATION

FIG. 24—NEUTRALIZED TWO-PHASE SERIES (CONDUCTION) MOTOR

FIG. 26—(SEPARATELY-EXCITED) SINGLE-PHASE SHUNT (CONDUCTION) MOTOR (WITH STATOR-EXCITATION)

FIG. 27—(SEPARATELY-EXCITED) NEUTRALIZED SINGLE-PHASE SHUNT (CONDUCTION) MOTOR (WITH STATOR-EXCITATION)

FIG. 28—(SEPARATELY-EXCITED) NEUTRALIZED SINGLE-PHASE SHUNT (CONDUCTION) MOTOR WITH ROTOR-EXCITATION

FIG. 29—(SEPARATELY-EXCITED) INDUCTIVELY-NEUTRALIZED SINGLE-PHASE SHUNT (CONDUCTION) MOTOR (WITH STATOR EXCITATION)

FIG. 30—SELF-EXCITED SINGLE-PHASE SHUNT (CONDUCTION) MOTOR (WITH ROTOR-EXCITATION)

FIG. 31—COMPENSATED SELF-EXCITED SINGLE-PHASE SHUNT (CONDUCTION) MOTOR (WITH ROTOR-EXCITATION)

FIG. 32—SELF-EXCITED SINGLE-PHASE SHUNT (CONDUCTION) MOTOR WITH ROTOR AND STATOR-EXCITATION

FIG. 33—(SEPARATELY-EXCITED) SINGLE-PHASE SHUNT INDUCTION MOTOR (WITH STATOR-EXCITATION)

FIG. 34—SELF-EXCITED SINGLE-PHASE SHUNT INDUCTION COMMUTATOR MOTOR (WITH ROTOR EXCITATION)

FIG. 35—COMPENSATED SELF-EXCITED SINGLE-PHASE SHUNT INDUCTION COMMUTATOR MOTOR (WITH ROTOR-EXCITATION)

FIG. 36—SELF-EXCITED SINGLE-PHASE SHUNT INDUCTION COMMUTATOR) MOTOR WITH ROTOR AND STATOR-EXCITATION

FIG. 37—SELF-EXCITED SINGLE-PHASE SHUNT INDUCTION-CONDUCTION (COMMUTATOR) MOTOR (WITH ROTOR-EXCITATION)

FIG. 38—SINGLE-PHASE SHUNT INDUCTION (COMMUTATOR) MOTOR WITH MIXED (ROTOR) EXCITATION

FIG. 39—SELF-EXCITED "SINGLE-PHASE SHUNT" INDUCTION MOTOR (WITH ROTOR-EXCITATION)

FIG. 40—COMPENSATED SELF-EXCITED SINGLE-PHASE SHUNT INDUCTION MOTOR (WITH ROTOR-EXCITATION)

FIG. 41—TWO-PHASE SHUNT-INDUCTION COMMUTATOR MOTOR (WITH STATOR-EXCITATION)

FIG. 42—COMPENSATED TWO-PHASE SHUNT INDUCTION COMMUTATOR MOTOR (WITH STATOR-EXCITATION)

FIG. 43—TWO-PHASE SHUNT INDUCTION-CONDUCTION (COMMUTATOR) MOTOR (WITH STATOR-EXCITATION)

FIG. 44—TWO-PHASE SHUNT INDUCTION MOTOR (WITH STATOR-EXCITATION)

FIG. 45—COMPENSATED TWO-PHASE SHUNT INDUCTION MOTOR (WITH STATOR-EXCITATION)

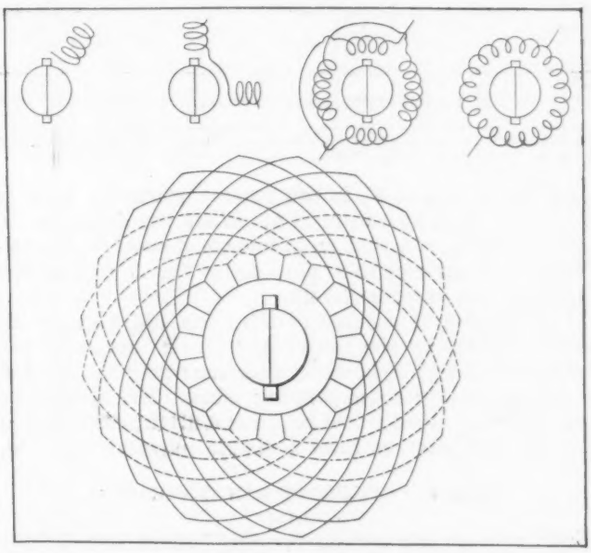
FIG. 46—NEUTRALIZED TWO-PHASE SHUNT CONDUCTION (COMMUTATOR) MOTOR (WITH STATOR EXCITATION)

FIG. 47—NEUTRALIZED AND COMPENSATED TWO-PHASE SHUNT CONDUCTION COMMUTATOR) MOTOR (WITH STATOR-EXCITATION)

CIRCUIT DIAGRAMS OF ALTERNATING-CURRENT MOTORS WITH NAMES SUGGESTED BY MR. FYNN

erated by the rotation of the armature is forced to flow through the field winding and thus dephases the field and consequently the electromotive force generated by rotation. Yet it is inferred from the logical conclusions in the paper that the motors rank in power-factor as follows: No. 13, "near unity"; No. 20, "lower than No. 13 but increasing with rising speed"; No. 14, "low at all speeds"; whereas, as a matter of fact, No. 13 and No. 14 are practically alike and fairly good, while No. 20 is excessively low. The reason why motor No. 20 has a better commutation can also be explained by taking into account the different field reactions.

Fig. 17, another well-known form of repulsion motor, also called the Deri motor, is classified as a "self-excited single-phase induction motor with rotor excitation and two independent rotor circuits." It is not clear from the discussion whether it is to be inferred from the classification that the rotor excitation means that the machine is self-compensating. However, it is said that the machine has the same general characteristics as the one shown in Fig. 13, which, it is claimed, is self-compensated. This is, however, an error as has already been pointed out.



TYPICAL WINDING DIAGRAM OF PLAIN REPULSION MOTOR WITH EQUIVALENT DIAGRAMMATIC REPRESENTATION

When two sets of brushes are introduced in order to make use of a true rotor excitation and power-factor compensation, the functioning of the motor becomes still more complicated and the chances for wrong conclusions still greater by leaving out some of the essential considerations in the abbreviated explanations. As an example of this, I wish to call attention to Fig. 21, classified as a "separately excited single-phase series induction motor with rotor excitation," and Fig. 35, classified as a "compensated self-excited single-phase shunt induction commutator motor with rotor excitation." The first of these is known as the Winter-Eichberg motor and the second as the "repulsion induction" motor. It is apparent from the two diagrams that these two motors are of substantially the same type except that one is a series motor and the other a shunt motor; both are compensated by the current in the exciting brushes. In both cases this current is substantially in phase with the main current and acts in the same way in producing the improvement of power-factor, yet one motor is classified as separately excited and the other as self-excited. Both motors are compensated in the same way, but the compensation is referred to in the classification of only one of the motors. The fact is that both of the motors are separately excited and self-excited at the same time and in the same way when they are being operated at the same speed. It depends upon the point of view whether one wishes to emphasize the one function or the other. The self-excitation furnishes in each case most of the electromotive force to produce the field current, but the separate excitation furnishes an additional electromotive force which brings the power-factor up so that the motor deserves the name of a compensated motor.

I believe it can be said not only that a student would probably be totally misled if he tried to arrive at a real understanding of alternating-current commutator motors by such an abbreviated theory as that given, but that a very thorough understanding such as can be possessed only by a few experts is necessary in order to appreciate the meaning of the explanation given and to see whether the explanation is correct or whether taken at its face value it would lead to errors.

If we look at the value of the classification given from the point of view of those who have to pass judgment on the complicated patent situation involved in this subject, I believe that an attempt of the Institute to adopt a classification like the one suggested and thereby confer upon it any measure of authority would be positively harmful. Such questions as whether a motor has stator or rotor excitation, whether it is self-compensated or not, whether it is self-excited or separately excited in accordance with the definitions given, are at least subject to argument. As a matter of fact, it is impossible to define the character of a motor of this kind by a conventional diagram. Most diagrams can be interpreted in more than one way, and it requires in many cases a complete explanation even of the phenomena of secondary magnitude in order to define what type of motor from a practical point of view it is intended to represent. The classified names that are suggested are still more inadequate to identify either a diagram or an actual motor, and, as has already been shown, in accordance with the system suggested, a motor may be placed in totally different classifications with alleged different characteristics, depending upon the point of view in identifying its windings, or on account of modifications of proportions that are really only a matter of degree.

The accompanying diagrams show four typical windings for a plain repulsion motor and the several possible diagrammatic representations. I believe a comparison of these diagrams would show without further explanation that it will be difficult to decide in accordance with Mr. Fynn's system whether any one of these windings should be represented and classified as a self-exciting, self-compensated motor with armature excitation and high power-factor or as a separately excited, non-self-compensated motor with stator excitation and low power-factor. Similar and even greater confusion could be shown in connection with any one of the other motors which are illustrated.

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Electric Cooking at Oregon Chautauqua

During the recent annual Chautauqua at Albany, Ore., the Oregon Power Company took advantage of the educational features of the conference to loan for the use of the domestic-science instructors a number of electric ranges and lamp-socket devices. At the same time the company maintained a salesman on the ground to handle inquiries, which as a result of the use of the ranges and appliances proved numerous. With the availability of its new cooking and heating rates, the company believes that a large business will be developed in this field.

SAG-TENSION CALCULATIONS

A Method of Solving the Cubic Equation Involved Without a Chart by the Use of a Short Tabulation

BY HAROLD PENDER

It is well known that the calculation of the change in the sag or tension in a wire or cable with temperature and loading involves the solution of a cubic equation. Various graphical and "cut-and-try" methods have been devised for the solution of this cubic. Graphical methods possess the disadvantage that every time a chart is used the rules for its use must be learned over again, at least if it is used infrequently; moreover, the range of application of a given chart is usually limited to a wire material of definite physical constants. Cut-and-try methods, although in general more readily understood and more flexible than the graphical methods, are tedious when many calculations have to be made. In this article a direct solution of this cubic is given, the only adjunct being a short table of numbers which are independent of the material of the wire.

Notation.—The following notation is used:

A = cross-section of the conductor in circular inches = square of diameter in inches = circular mils divided by 1,000,000.

a = coefficient of linear expansion of the conductor per degree Fahrenheit.

D = deflection, in feet (in the direction of the *resultant* transverse force), of the lowest point of the conductor, for any loading w and temperature t.

F = horizontal component of the stress in the conductor, in pounds, at any loading w and temperature t. F is very nearly equal to the resultant stress in the wire at this temperature and loading.

L = length of span in feet, i.e., the horizontal distance between the two points of support.

M = modulus of elasticity of the conductor in pound-inch units.

S = vertical sag, in feet, of the lowest point of the conductor, for any loading w and temperature t.

t = temperature of the conductor in degrees Fahrenheit when the deflection is D.

v = resultant of weight of wire and ice, in pounds per foot of conductor, at the temperature t.

w = resultant, in pounds per foot of conductor, of the weight of the conductor, the ice load and the wind load, at the temperature t.

D_0, F_0, S_0, t_0, v_0 and w_0 are used to designate the values of D, F, S, t, v and w when the loading is w_0 and the temperature t_0.

Fundamental Relations.—The relation between the deflection, length of span, loading and stress at any temperature, is

$$D = \frac{wL^2}{8F}, \qquad (1)$$

where w and F are the loading and tension at this temperature. When there is no wind, D is also equal to the vertical sag of the wire. When there is wind, producing a horizontal transverse force on the conductor, the vertical sag is

$$S = \frac{v}{w}D. \qquad (2)$$

When the temperature changes from t_0 to t and the loading from w_0 to w, the deflection changes from the value D_0, corresponding to t_0 and w_0, to a new value D, corresponding to t and w. This new value D must satisfy the equation

$$D^3 + \frac{3L^2}{8}\left[\frac{1.273F_0}{MA} - \left(\frac{w_0L}{4.9F_0}\right)^2 - a(t-t_0)\right]D = \frac{wL^4}{16.74MA}. \qquad (3)$$

TABLE I*—VALUES OF y IN TERMS OF x

$e_1 > (e_2+e_3)$

x	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0013	0.0025	0.0036	0.0047	0.0057	0.0067	0.0076	0.0084	0.0092
0.1	0.0099	0.0106	0.0113	0.0119	0.0125	0.0130	0.0135	0.0140	0.0145	0.0150
0.2	0.0154	0.0158	0.0162	0.0166	0.0170	0.0174	0.0178	0.0182	0.0185	0.0188
0.3	0.0191	0.0194	0.0197	0.0200	0.0203	0.0206	0.0209	0.0212	0.0215	0.0218
0.4	0.0221	0.0224	0.0227	0.0229	0.0231	0.0233	0.0235	0.0237	0.0239	0.0241
0.5	0.0243	0.0245	0.0247	0.0249	0.0251	0.0253	0.0255	0.0257	0.0259	0.0261
0.6	0.0263	0.0265	0.0267	0.0269	0.0271	0.0273	0.0275	0.0277	0.0279	0.0281
0.7	0.0283	0.0285	0.0287	0.0289	0.0291	0.0293	0.0295	0.0297	0.0299	0.0301
0.8	0.0303	0.0304	0.0305	0.0306	0.0307	0.0308	0.0309	0.0310	0.0311	0.0312
0.9	0.0313	0.0314	0.0315	0.0316	0.0317	0.0318	0.0319	0.0320	0.0321	0.0322

x	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
1	0.0327	0.0340	0.0352	0.0363	0.0373	0.0383	0.0392	0.0401	0.0410	0.0418
2	0.0426	0.0434	0.0442	0.0449	0.0456	0.0463	0.0470	0.0477	0.0484	0.0490
3	0.0496	0.0502	0.0508	0.0514	0.0520	0.0526	0.0532	0.0537	0.0542	0.0547
4	0.0552	0.0557	0.0562	0.0567	0.0572	0.0577	0.0582	0.0587	0.0591	0.0595
5	0.0599	0.0603	0.0607	0.0611	0.0615	0.0619	0.0623	0.0627	0.0631	0.0635
6	0.0639	0.0643	0.0647	0.0651	0.0655	0.0659	0.0663	0.0666	0.0669	0.0672
7	0.0675	0.0678	0.0681	0.0684	0.0687	0.0690	0.0693	0.0696	0.0699	0.0702
8	0.0705	0.0708	0.0711	0.0714	0.0717	0.0720	0.0723	0.0726	0.0729	0.0732
9	0.0735	0.0738	0.0741	0.0744	0.0747	0.0750	0.0753	0.0756	0.0759	0.0762

x	0	1	2	3	4	5	6	7	8	9
10	0.0765	0.0789	0.0812	0.0834	0.0855	0.0875	0.0894	0.0913	0.0931	0.0949

*This table is to be used like a table of logarithms, *e.g.*, the value of y for $x=0.63$ is 0.0269; for $x=4.7$, $y=0.0587$; for $x=14$, $y=0.0855$.

In this equation F_0 is the tension when the loading is w_0 and the temperature is t_0. When the deflection D_0 corresponding to t_0 and w_0 is known, instead of F_0, calculate F_0 from equation (1), using for D and w the values D_0 and w_0 respectively.

The solution of a cubic of the form (3) may be affected directly by the use of hyperbolic functions, but the direct use of hyperbolic functions may be avoided by employing the accompanying table. The method of procedure described below requires only the calculations of such quantities as have a simple physical meaning.

TABLE II*—VALUES OF y IN TERMS OF x

$e_1 < (e_2+e_3)$

x	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0194	0.0200	0.0205	0.0210	0.0215	0.0220	0.0224	0.0228	0.0232	0.0236
0.1	0.0239	0.0242	0.0245	0.0248	0.0252	0.0255	0.0258	0.0621	0.0263	0.0266
0.2	0.0269	0.0272	0.0274	0.0277	0.0279	0.0281	0.0283	0.0286	0.0288	0.0290
0.3	0.0292	0.0295	0.0297	0.0299	0.0300	0.0302	0.0304	0.0306	0.0308	0.0310
0.4	0.0312	0.0314	0.0316	0.0318	0.0320	0.0322	0.0323	0.0325	0.0327	0.0329
0.5	0.0330	0.0332	0.0333	0.0335	0.0337	0.0338	0.0340	0.0341	0.0343	0.0345
0.6	0.0346	0.0348	0.0349	0.0350	0.0352	0.0353	0.0354	0.0356	0.0358	0.0359
0.7	0.0360	0.0361	0.0362	0.0363	0.0365	0.0366	0.0368	0.0369	0.0360	0.0371
0.8	0.0372	0.0373	0.0374	0.0375	0.0377	0.0378	0.0379	0.0380	0.0381	0.0383
0.9	0.0384	0.0385	0.0386	0.0387	0.0388	0.0390	0.0391	0.0392	0.0393	0.0394

x	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
1	0.0395	0.0406	0.0416	0.0425	0.0434	0.0443	0.0451	0.0459	0.0467	0.0475
2	0.0482	0.0490	0.0497	0.0504	0.0510	0.0516	0.0522	0.0528	0.0534	0.0539
3	0.0544	0.0560	0.0566	0.0571	0.0577	0.0581	0.0586	0.0591	0.0596	0.0590
4	0.0595	0.0600	0.0604	0.0609	0.0613	0.0617	0.0621	0.0625	0.0629	0.0633
5	0.0637	0.0641	0.0645	0.0649	0.0653	0.0657	0.0660	0.0663	0.0667	0.0670
6	0.0673	0.0677	0.0681	0.0685	0.0689	0.0692	0.0695	0.0698	0.0701	0.0704
7	0.0708	0.0711	0.0714	0.0717	0.0720	0.0723	0.0726	0.0729	0.0732	0.0735
8	0.0738	0.0741	0.0743	0.0747	0.0749	0.0751	0.0754	0.0757	0.0760	0.0762
9	0.0765	0.0768	0.0771	0.0773	0.0776	0.0779	0.0781	0.0784	0.0787	0.0789

x	0	1	2	3	4	5	6	7	8	9
10	0.0792	0.0817	0.0840	0.0861	0.0881	0.0900	0.0919	0.0937	0.0954	0.0970

*This table is to be used like a table of logarithms, *e.g.*, the value of y for $x=0.63$ is 0.0350 for $x=4.7$, $y=0.0625$; for $x=14$, $y=0.0881$.

*Working Formulas.**—The elongation, in feet per thousand feet, of a straight wire when subjected to a stress of F_0 pounds, is

$$e_1 = \frac{1273F_0}{MA}. \qquad (4)$$

The length of the stressed wire in a span is greater than the length of the span by an amount depending upon the loading, length of span, and the stress. This excess length in feet per thousand feet of wire, for any loading w_0 and temperature t_0, is

$$e_2 = \left(\frac{w_0 L}{0.155F_0}\right)^2. \qquad (5)$$

The elongation of a thousand-foot length of straight wire, when its temperature changes from t_0 to t degrees, is

$$e_3 = 1000a(t - t_0). \qquad (6)$$

The elongation, in feet per thousand feet of wire, when a straight wire of length L is subjected to a stress equal to wL (= its own weight plus the total ice and wind load, if any, at the temperature t) is

$$e = \frac{1273wL}{MA}. \qquad (7)$$

When e_1 is greater than $(e_2 + e_3)$, put

$$E = e_1 - (e_2 + e_3), \qquad (8)$$

and when e_1 is less than $(e_2 + e_3)$, put

$$E = e_2 + e_3 - e_1. \qquad (8a)$$

Then, in either case, calculate

$$x = \frac{e}{E\sqrt{E}}. \qquad (9)$$

From Table I or Table II, accordingly as e_1 is greater or less than $(e_2 + e_3)$, take the value of y corresponding to this value of x. Then the deflection D at temperature t and loading w is

$$D = yL\sqrt{E}. \qquad (10)$$

The corresponding stress F may then be calculated, if desired, from (1).

For x greater than 19, the limit of the tables, $D = \frac{L\sqrt[3]{e}}{27.7}$ with an error of less than 1 per cent.

Example.—To find the sag at which a No. 0 B. & S. stranded copper wire must be strung at 60 deg. Fahr. on a 400-ft. span so that the wire will have a factor of safety of two at 0 deg. Fahr. when loaded with ice 0.5 in. thick all around the wire and with a wind pressure of 8 lb. per square foot of projected area. The breaking strength of the wire is 4980 lb., cross-section 105,500 circ. mils, modulus of elasticity 16×10^6, and coefficient of expansion 9.6×10^{-6}.

The data and calculations are then as follows:

$F_0 = 2490$, $M = 16 \times 10^6$,
$w = 0.323$, $L = 400$,
$w_0 = 1.26$, $t - t_0 = 60$,
$A = 0.1055$, $a = 9.6 \times 10^{-6}$.

Then

$$e_1 = \frac{1273 \times 2490}{16 \times 10^6 \times 0.1055} = 1.878,$$

$$e_2 = \left(\frac{1.26 \times 400}{0.0155 \times 2490}\right)^2 = 1.705,$$

$$e_3 = 1000 \times 9.6 \times 10^{-6}\, 60 = 0.576,$$

$$e = \frac{1273 \times 0.323 \times 400}{16 \times 10^6 \times 0.1055} = 0.0975.$$

Noting that e_1 is less than $(e_2 + e_3)$,

$$E = 1.705 + 0.576 - 1.878 = 0.403,$$

$$x = \frac{0.0975}{0.403\sqrt{0.403}} = 0.382,$$

and, from Table II, $y = 0.0308$. Whence

$$D = 0.0308 \times 400\sqrt{0.403} = 7.82 \text{ ft.}$$

This is the sag at 60 deg. Fahr. with no ice or wind.

The sag at 0 deg. Fahr. with no ice or wind is found in exactly the same way, noting that for these conditions $e_2 = 0$, and e_1 is greater than $(e_2 + e_3)$, giving for E the value $1.878 - 1.705 = 0.173$, and for x the value $\frac{0.0975}{0.173\sqrt{0.173}} = 1.355$, and y from Table I is then 0.0367, and $D = 0.0367 \times 400\sqrt{0.173} = 6.10$ ft.

Appendix.—All the values of y in Table I are calculated from the formula

$$y = \frac{1}{\sqrt{2000}} \sinh\left[\frac{1}{3}\sinh^{-1}\left(\frac{30\sqrt{20}}{8}\,x\right)\right].$$

The values of y given in Table II for all values of x less than $\frac{8}{30\sqrt{20}}$ are calculated from the formula

$$y = \frac{1}{\sqrt{2000}} \cos\left[30° - \frac{1}{3}\sin^{-1}\left(\frac{30\sqrt{20}}{8}\,x\right)\right].$$

The values of y given in Table II for all values of x greater than $\frac{8}{30\sqrt{20}}$ are calculated from the formula

$$y = \frac{1}{\sqrt{2000}} \cosh\left[\frac{1}{3}\cosh^{-1}\left(\frac{30\sqrt{20}}{8}\,x\right)\right].$$

*e_1, e_2 and e_3 are respectively 1000 times the first, second and third terms in the square bracket in equation (3). e is $\frac{64{,}000}{3L^3}$ times the right-hand member of (3). The elongations are expressed in feet per thousand feet in order to avoid extremely small numbers in numerical calculations.

Generation of Electricity Is Not Manufacture

In the United States District Court Judge Witmer, in dismissing a creditor's petition for the adjudication of the affairs of the Wilkes-Barre Light Company, handed down the opinion that a company engaged in generating electricity is not a manufacturer, nor is it a merchant when it sells its energy, and that therefore the company did not commit an act of bankruptcy while insolvent by applying to the court for the appointment of a receiver. The Wilkes-Barre Light Company, which is a small company, was incorporated April 19, 1910, and furnishes energy to a limited section of the city of Wilkes-Barre. The text of Judge Witmer's decision in part is as follows:

"I record myself with those of the opinion that generating electricity is not manufacturing, nor is the directing of electricity over lines of wires to consumers for a consideration a mercantile pursuit within the meaning of the bankruptcy act. The company has the right to a certain extent of exercising eminent domain, and is therefore correlatively charged with a duty to the public which is no part of the duties of an ordinary corporation engaged in manufacturing, trading, printing, publishing, mining or mercantile pursuits. It is a utility corporation by necessity of the law creating it as such; an impress of this character is influenced by statute, and though municipal consent may be withheld for a time, as in the case before us, the end or character of the corporation is not changed, nor is it dependent on the action of the municipality conferring or vacating the right of public franchise. The Legislature has also stamped the character and nature of this class of corporations upon their charter, and by the act of July 26, 1913, defines a public service company without reservation as to those including electric corporations."

Mobile Color and Stage Lighting—III

Specifications for Lamps for Stage-Lighting Work—Synthesis of Color Effects—Selection of Scenery for Modern Productions

BY BASSETT JONES

IN the preceding installments of this article the author discussed at length the artistic possibilities of stage illumination and described in detail some of the special equipment employed in securing scenic effects of extraordinary beauty. Included in this apparatus may be mentioned "spot" units, "basket" lamps, flood lamps, parabolic-strip units and color-mixing strips.

Following herewith there are given specifications for lamps for stage-lighting work, and the present installment closes with a discussion of synthetic illumination and the proper selection of scenery for effective results under the illumination described.

The relative value of the vacuum lamp and the gas-filled lamp is of importance. Of course, higher efficiencies are possible with the gas-filled lamps, particularly in the larger sizes. They also give light of a much better color than the vacuum lamps. Special care has to be taken with the design and manufacture of gas-filled lamps to operate in any position, owing to the excessive heat at the point of contact between the inclosure and the convection currents in the gas. The vacuum lamp, of course, gives considerably less light than the gas-filled lamp within the range of ratings here considered, even when the efficiency has been sacrificed for ruggedness. While the temperature of the gas-filled lamp is high, yet it is a much "cooler proposition" than the open arc spot lamp and does not introduce the same fire hazard. It requires no hot balancing rheostat. Its starting current is nil.

It is frankly admitted that the smaller gas-filled lamp in its present state has not altogether proved its adaptability to theatrical work, while the same ratings in vacuum lamps have lived through very severe usage and have shown a long life as things go, theatrically speaking. It is only fair to the gas-filled lamp to say that lamps built to the following specifications have been put on "the road" recently (February, 1915), and have shown a marked improvement over any other gas-filled lamps that have been tried. Some of these lamps have now served through three months of one-night stands, with life records still incomplete. Some of the 300-watt vacuum lamps have lived through two road seasons of forty weeks each.

The so-called "stereopticon" style of gas-filled concentrated-filament lamp, rated at 250 and 500 watts, is not suitable for theatrical work. The close concentration of its filament, while essential for stereopticon use, materially reduces the life of the lamp. Such lamps are guaranteed for a life of only 250 hours, which makes their maintenance very expensive. Furthermore, they can be operated only with the tip up, because the base, being close to the filament, is subject to excessive temperature if the lamp is operated with the tip in the lower hemisphere. The small bulbs used cause the lamp to become very hot, and blistering frequently occurs.

Excellent ventilation is imperative with the gas-filled lamps, and such ventilation is not always practicable in theatrical devices.

Recommendations are, therefore, made for specifications covering both gas-filled and vacuum lamps which should be followed in purchasing supplies.

Specification for Concentrated-Filament, Gas-Filled Tungsten Lamps

(1) 300-watt, 110 volts; medium concentration: PS-35 bulb; to operate in any position; Mogul base; light-center distance, 6⅝ in.; length over all, 9¼ in.

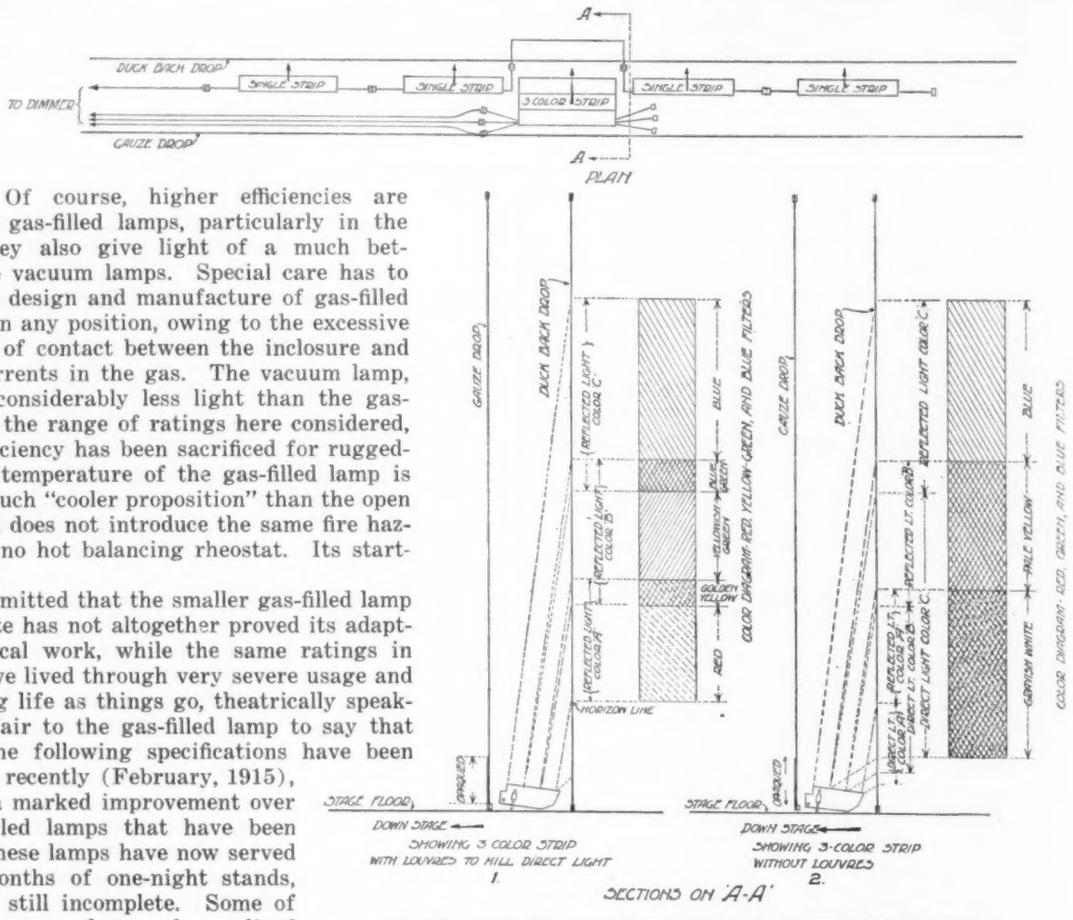


FIG. 14—TYPICAL ARRANGEMENTS OF THREE-COLOR STRIPS

(2) 400-watt, 110 volts; medium concentration; PS-40 bulb; to operate in any position; Mogul base; light-center distance, 7½ in.; length over all, 10½ in.

Specification for Concentrated-Filament, Vacuum Tungsten Lamps

(1) 300-watt, 110 volts; medium concentration; PS-56 bulb; to operate in any position; Mogul base; light-center distance, 6⅝ in.; length over all, 10⅜ in.

(2) 100-watt, 110 volts; medium concentration; G-30 bulb; medium-screw skirted base; light-center distance, 4¼ in.; length over all, 6⅛ in.

The voltage given is that which has proved most gen-

erally satisfactory for service all over the country. Of course, if the lamps are to be used only in one locality, the proper and most efficient voltage for that locality may be used in the specification. The light-center distance, being the distance from the bottom contact on the base to the center of the filament, is important, as all the devices have been adapted for this length as an average. It is particularly important to specifiy skirted bases on the 100-watt sizes. If skirted base lamps of this size are not obtainable, extension sockets may be used. The skirt is necessary as a means of clamping the hemispherical reflector in place.

It is, of course, important not to operate the lamps much over their rated voltage if long life is desired. If 110-volt lamps are used and occasionally higher voltages are encountered, then part of the dimmers should be kept in circuit. A little practice will soon enable the operator to tell by the appearance of the lamp when lighted whether or not it is being operated at about its proper voltage.

For watt ratings above those given in the suggested specifications, the standard gas-filled lamps are quite satisfactory, except that they must be specified to operate in any position. This requires additional filament supports which introduce a cooling factor somewhat reducing the efficiency.

It is well to insert here a word of caution to the effect that not all makes of lamps have proved satisfactory for stage work.

Synthetic Stage Illumination

The general method of synthetic illumination lends itself very readily to stage lighting, particularly in the cases of permanent installation. The general method comprises primarily the production of any desired resultant color in illumination by the synthesis or mixing together of lights of different color. The most complete example of the method is the three-color system already mentioned under "color-mixing strips." This system was first used by the writer about five years ago. Each light source is used with a different color filter, and the color of the light received on the scenery is a mixture or the resultant of the relative amounts of light emitted by the several sources, these amounts being controlled by independent dimmers connected into the circuits on each source.

If a particular red, a particular green and a particular blue color filter are used, then light of any color, red, orange, yellow, green, blue-green, blue or purple, or any intermediate shade, can be produced by mixing proper amounts of such red, green and blue light. A fourth element, white, is usually added to desaturate or make more pale any color tone. Even a reasonably close match for daylight may be produced, and if the color filters used are properly selected for transmission, little distortion of colors in material so illuminated need occur. In other words, a daylight can be so produced that not only looks like daylight but acts like daylight in many important particulars.

One interesting effect arranged by the writer to illustrate the serviceability of the devices for producing mobile color was accomplished by employing three flood lamps, each provided with a suitable silhouette diaphragm in the reflector aperture. Use was made of red, green and blue filters and a double gauze drop backed by black canvas. First, the drop receives white light by mixture. A gradual separation of colors then takes place till finally there are regions of pale tints. These slowly condense to three segments, which gradually form themselves into a complete chromatic circle. The circle contracts to a white spot and finally fades out.

A stage equipped with strip, flood and border lamps arranged in this way can display any color in light and any sequence in color or tones. Only three gelatine colors are used and only three (sometimes four) circuits. The dimming equipment can be very simple. Six plates, or eight at the most, would be necessary for even a very elaborate production. Several "set-ups" using the devices above described are shown in Figs. 13, 14, 15 and 16.

All of the devices were built from the writer's designs by the I. P. Frink Company, to whom he owes much for practical suggestions, unending patience, and help in overcoming numerous difficulties.

Scenery

Nowadays one hears a great deal of the scenic artist. True, in many cases, his work expresses great imaginative power and shows remarkable technical skill in execution. But the danger to which most of these men have succumbed is that of over-accentuating the scenery and its accessories at the expense of the actors and the action. This results in necessarily dressing up the actors to the scenery, against which overpowering back-

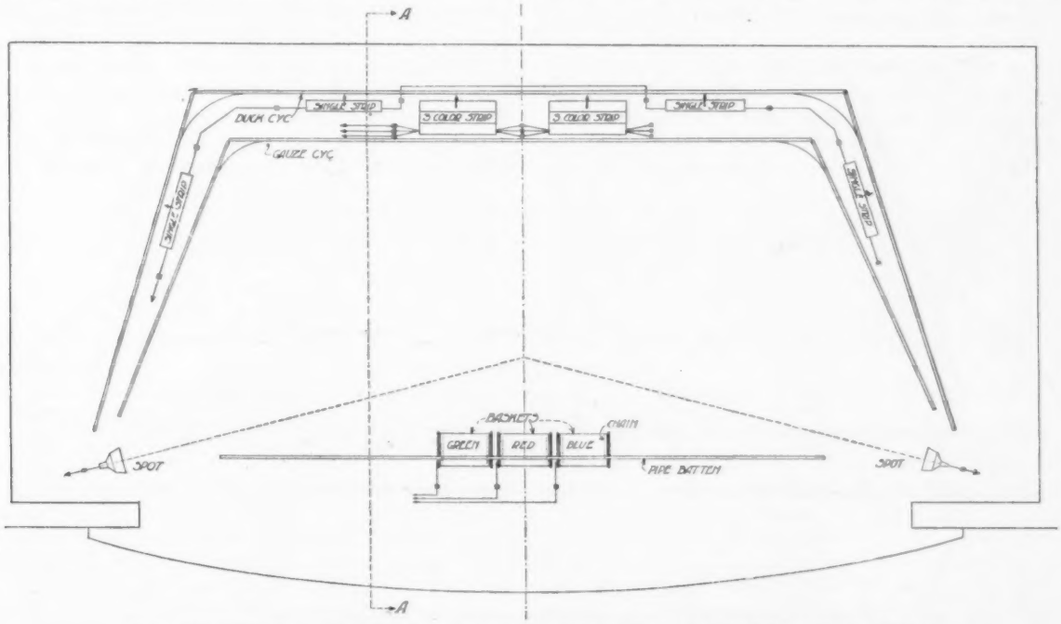


FIG. 15—TYPICAL GENERAL LIGHTING SET-UP FOR COMPLETE COLOR CYCLE

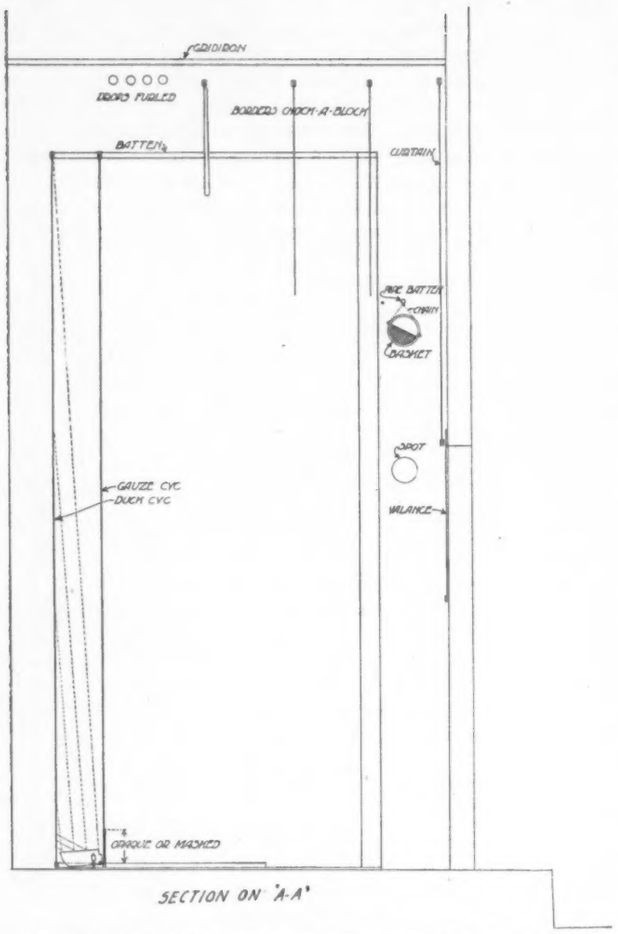


FIG. 16—SECTION THROUGH SET-UP SHOWN IN FIG. 15

ground they must play. The attention of the audience is rather on the picture than on what is said or done on the stage. The players are reduced to mere marionettes and the play to a scenic accompaniment.

Of course, I am not referring to the garish crudities that draw the Broadway crowds, but to those serious attempts to better stage art that so frequently result in attracting people not so much to see the play as to see what the production manager has to show in the way of scenic "stunts."

The play is an animated picture of life. The scenery is not "the thing." Rather is it a setting suggestive of the surroundings in which the action occurs—a background that serves by contrast to focus attention on the players. Neither by its presence nor by its absence should it detract from the play, and least of all should it raise in the mind of the beholder any interest as to how it is done.

Truly dramatic situations demand dramatic backgrounds. But dramatic situations in this sense are rare. An act which culminates in one great dramatic moment demands that the setting itself present something in the nature of dramatic development. If the scenery is designed up to the final situation, then the situation becomes an anticlimax. On the other hand, if the setting does not meet the situation, the climax loses force.

The art of the stage does not consist in presenting a dramatic episode in the midst of humdrum, every-day surroundings, but in setting off this episode against a background just as imaginative as the play itself and just as interpretative of nature as the drama is of life.

The producer thus often finds himself faced by a two-horned dilemma as the static nature of his material rarely permits a happy solution, even if his imagination succeeds in conceiving an ideal setting of just the right mobility.

One very fruitful mode of attacking this difficulty lies through the use of mobile color. There is no reason why the appearance of the background cannot be modulated and varied by the use of suitable lighting effects so that the feeling produced is expressive of the mood in which the play develops. This, of course, demands a careful study, not only of the setting itself—of the design, materials, and color used in painting or dyeing the scenery—but also of the effects produced by variations in hue, intensity and distribution of light.

In the design of the scenery itself, simplicity both in line and in hue generally produces effects much more appropriate than an elaboration of detail which serves only to detract from the interest in the action. Such simple settings also lend themselves better to color play, as the balances in mass and hue are more easily controlled. However, there are cases where realism and detail are demanded.

As an example of the extreme of simplicity, consider the graveyard scene in "Hamlet," often produced with a wealth of detail quite out of keeping with the simplicity of the action. The mood is somber rather than ghastly. The lines are philosophical rather than poetical. Yet the balance between what is repulsive and what is appealing is so closely drawn that a slightly over-accentuated setting may entirely distort the meaning that the poet intended to convey. The distinction between the ridiculous and the sublime is whetted exceeding sharp. The speech of the gravedigger is close to the soliloquy. The tinge of amusement should be just enough to give the required contrast, and no more. And, in the setting, pale and leaf-filtered moonlight gradually eclipsed will save the situation. The mind is stressed by sorrow.

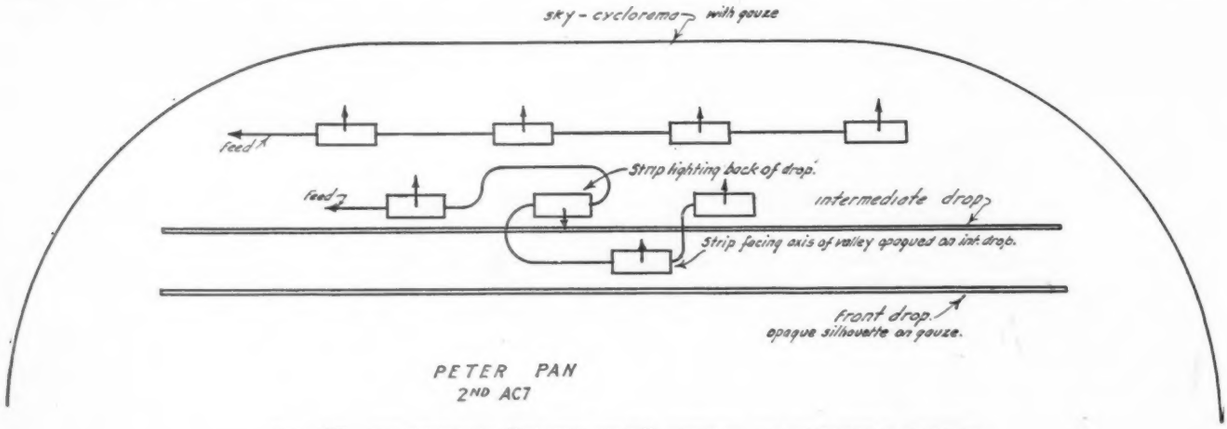


FIG. 17—CORRECTING "WATER-SILK" EFFECT IN MULTIPLE GAUZES

Thought struggles with understanding in mysterious depths, illuminated only through death. Sanity trembles in the balance.

The scene requires moodiness, a background of shadowy notes, a mere suggestion of woodland, too dark for clear distinction. The gloomy character of the setting becoming more and more marked as the Dane's soul is itself plunged deeper into the tragic abyss—and this abyss a grave—a single black and gaping hole, vast enough to receive all the unhappiness with which his speech is laden.

From this note, almost of negation in stage setting, we may go to a scene such as the battle in "Henry V," requiring the utmost mechanical ingenuity. This scene lends itself essentially to tableaus. As Sir Henry Irving staged it, the background was panoramic in nature, showing the tremendous onslaught of the contending armies, the scene brought down to the front by masses of fighting men. The scenery here demands realism in the extreme, with a wealth of perfect detail. In our modern times action might even be introduced by the aid of moving pictures, the background showing the ebb and flow of the fight, while in the foreground human beings filled with the lust of strife struggle and die.

And so between these two extremes there lie possibilities unending in variety of form and character—the fairylike setting for a childlike Peter Pan, the dim mystery of Pelléas and Mélisande.

It must be obvious from what has been said that the texture of the scenery and the coloring materials should receive more than passing attention. Indeed, on this subject a volume might be written.

Pigmented canvas is quite hopeless. The effects are harsh even under the best conditions, and, as such scenery is usually executed, it is an abortion. After an experience with linens, gauzes and duck dyed with proper anilines, painted scenery always seems crude. Stenciled designs on gauze opaqued with black linen where necessary, or backed with black canvas, or even stenciled on the gauze alone without backing, where transparency and unsaturated hues are wanted, produce effects of perfect and soft pastel-like hues. The dyeing is usually done through stencils with an air gun and brushed over with the gun afterward to bring out detail. Fine detail is not wanted and is generally destructive of the bold effects of color and line. A little pigment of carefully chosen quality and hue may sometimes be used on high lights, but rarely, and then with circumspection. The dye impregnates the material so that there is no reflection from hard surfaces or a white back, and so all the light reflected is pure in hue and soft in tone. Such light as is not modified in color by the dye passes through or is absorbed by the black backing, where such exists, and so does not modify the hue of the reflected light.

A light-blue canvas back behind a blue-green gauze drop as described above, and so lighted, using very light-blue color filters, gives a perfect daylight atmosphere and totally deceives as to distance. Dim the canvas back and light the gauze, and through it the back, by pale blue-green light, and the feeling is of a moonlight-saturated sky.

The bottom of the front gauze may be opaqued and dyed to represent a middle foreground. There may be, perhaps, some silhouetted trees; above, dyed on the transparent gauze, the distant hills. In this way two planes may be established on a single drop. In front may be a second gauze with opaque, silhouetted foreground; the parts not silhouetted a dark gray, through which, as through the intervening atmosphere, is seen the truly distant background, and beyond the endless spaces of the sky.

So remarkable are the possibilities of this form of scenery that the writer has produced a single drop, prepared by the Hewlett-Basing Studios, on which foreground, middle ground, background and sky were dyed in different tones, the effects of distance including a rich sunset over the distant hills that was absolutely deceiving. Beholders had to go to the stage to convince themselves that use was made of only one drop tacked flat upon a wall.

Scenery of this sort and the lighting devices described, of course, lend themselves to a saving of stage depth that is of great importance.

It might seem to those not familiar with the use of gauze scenery that it would prove too delicate for the rough handling it is certain to receive. That it will tear more readily than canvas is obvious. On the other hand, it is so light, flexible and easily handled that it would not be injured where canvas scenery would be seriously defaced. Being dyed, the coloring matter cannot be scratched, cracked or flaked. The scenery can be rolled and folded without injury. It is usually shipped in tarpaulins and thus the space required in the baggage car is much reduced. It is exceedingly light. If torn, it can be sewed, and usually the seam will not show. If injured beyond repair, it can be quickly and easily replaced, as the stencils, once made, are good for any number of repetitions, and the production from the stencils can be executed very rapidly.

The use of two or more thicknesses of gauze requires certain precautions to obviate a watered-silk effect due to the co-ordination of the several meshes. This effect, if not remedied, will prove very disagreeable. By employing gauzes of different mesh dimensions, the mesh width increasing down stage with successive drops, this trouble can be corrected within limits. If three gauzes are used, it may be necessary to light the back of one drop, which has the effect of making the threads invisible. A set lighted in this way is shown in **Fig. 17.**

In the following installments of this article the selection, blending and use of pigments, dyes and color filters will be discussed.

Illuminated Advertising Trucks

Another new chapter has been added to the already large volume of advertising by electricity. The Animated Sign Company of Boston, Mass., and the W. J. Lemp Brewing Company of St. Louis, Mo., have both placed illuminated trucks in operation in Los Angeles,

TRUCKS BEARING ILLUMINATED SIGNS

Cal., one advertising cigarettes, the other beer. The electrical equipment of the Animated Sign truck consists of twenty-eight fifteen-plate lead storage cells, a number of 10-watt lamps, a 1-hp. Emerson motor and a motor-driven commutator. The Lemp truck is illuminated by 116 15-watt lamps fed from a lead battery of fifty fifteen-plate cells. This battery takes a full charge of 30 kw-hr. and will light the sign for approximately ten hours or for about two evenings.

DIGEST OF ELECTRICAL LITERATURE

Generators, Motors and Transformers

Rolling-Mill Equipment.—An illustrated description of the electrical equipment made by a British company for controlling the reversible motors driving the live rolls. The system comprises the use of a manually operated master controller and electrically operated contactor switches, the contactors closing partly under the influence of the master controller and partly of the main current.—London *Electrician*, June 25, 1915.

Phase Compensator with Shunt Regulation.—A. Scherbius.—The most economical method of compensating phase difference is the use of statorless phase compensators with series excitation. By saturating the iron to an unusually high degree it is possible to build compensators in such a way that at loads as low as one-fifth of the normal full load of the main motor the power-factor is brought to unity. Nevertheless it has occasionally been found desirable to obtain perfect phase compensation even at no load. This is especially the case when the main motors serve not simply as driving motors but are also expected to improve the power-factor of the network in the same way as synchronous

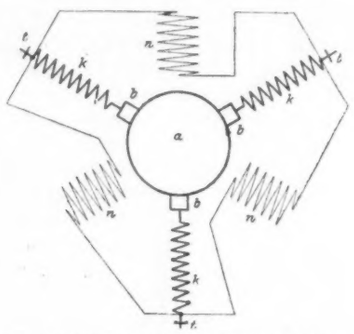


FIG. 1—PHASE COMPENSATOR WITH SHUNT REGULATION

motors running without load. For this purpose frequency transformers have been used as phase compensators, but this involves complications, and the author shows that practically the same result can be obtained by means of phase compensators with shunt excitation. A polyphase shunt commutator machine is connected in cascade with the main motor, and the shunt commutator machine is designed so that the armature currents are completely compensated for by the compensation windings on the stator, and hence there will be no reaction of the armature current on the field. Fig. 1 represents such a three-phase machine. *a* is the armature, with its brushes at *b*. The compensating windings are indicated by *k* and the terminals by *t*. The shunt windings are indicated by *n*. Some special features of the design are discussed, and the vector diagram of the machine is given with an explanation of some peculiarities that are characteristic of its operation.—*Elek. Zeit.*, June 17, 1915.

Lamps and Lighting

Electric Lighting in Russia.—A review of the development of electric lighting in Russia with special reference to the proposed tax on electricity. Some statistical data are given which show that electric lighting is at present in a period of rapid progress in Russia but is not yet so far advanced that a tax on electricity would bring large amounts of money. A comparison is made with the Russian tax on kerosene for lighting. If a tax is laid on electricity, care should be taken not to hurt the growth of the electrical industry. Some suggestions are made as to different taxes for different classes of lighting in large cities and correspondingly smaller taxes in country towns.—*La Lumière Elec.*, May 15, 1915.

Generation, Transmission and Distribution

Switchboards.—B. P. Rowe.—In a continuation of the long illustrated serial on the engineering evolution of electrical apparatus, the author deals with the evolution of switchboards with special reference to the practice of the Westinghouse company.—*Elec. Journal*, July, 1915.

British Central Stations.—A note stating that, notwithstanding the war, the accounts of British municipal electricity undertakings for the year to March 31, 1915, which are being gradually published, show, on the whole, increases in output. At the same time increases in charges are becoming more general, owing to the higher price of coal, labor, etc. The Edinburgh city electrical engineer deprecates refusing to connect new consumers for the sake of releasing further members of his staff in view of the check this will have upon the development of the undertaking.—London *Elec. Eng'ing*, July 8, 1915.

Protecting Electrical Machinery Against Abnormal Electrical Conditions.—C. C. Garrard.—A continuation of his illustrated article. The author gives an account of Berg's experiments on the pressure rises produced by arcing grounds and describes the Creighton arcing-ground suppressor. A brief description is given of the construction of the arc-suppressing relay.—London *Electrician*, June 25, 1915.

Traction

Electric Traction in Spain.—W. Reinhart.—A statistical article on electric traction in Spain. The author gives a map and two tables listing data on twenty-three electric street-railway systems, nineteen interurban railway systems and two electric trunk railways in Spain. Of the last mentioned only one is so far in operation. This is the line from Gergal to Santa Fé near Almeria. It was originally operated by steam, but it was later electrified to increase its capacity. It serves mainly for transportation of ore from the mountains to the valley, down a grade of 28 per cent. In order to regenerate energy a three-phase system is used. The trains loaded with ore running down grade average about 450 tons, and the trains running up the mountains weigh about 150 tons. The double locomotives used weigh 52 tons and each half is equipped with two 160-hp. motors, making 640 hp. per train. The trolley-wire pressure is 6000 volts and the frequency is twenty-five cycles. The second electric trunk railway will be opened in 1916. It will serve chiefly for ore transportation between Huelva and Rio Tinto. The line is 83 km. (50 miles) long. From 2,000,000 tons to 2,500,000 tons of ore and copper are to be transported. This line will also be operated by a three-phase system. The fact that for these two mountain lines three-phase systems are used will have no effect on the choice of system should the whole railway system of Spain be electrified in order to make use of the available water-powers. It is probable that the single-phase system will be used, or perhaps the high-tension direct-current system should that be found more practicable.—*Elek. Kraft. u. Bahnen*, May 14, 1914.

Lyons.—P. Sabe.—The Lyons tramway system is one of the most important in France. In 1914 it had 1127 cars. The system is particularly interesting on account of its suburban lines, which extend a distance of 50 km.

to 60 km. (30 miles to 36 miles) from the city. For these suburban lines special cars are used, which run at higher speeds and offer more comfort. Each car is supplied with two four-wheel trucks and is provided with four 50-hp., 600-volt direct-current motors.—*La Lumière Elec.*, June 5, 1915.

Installations, Systems and Appliances

British Central Station.—An illustrated account of recent extensions of plant at the British central station at Salford. While originally founded as a single-phase plant it was later changed to a direct-current station and continually enlarged until all the available space was fully occupied with eight engine sets and three direct-current turbo sets, having a total rating of 9400 kw. To meet the increased demand a 5000-kw. turbo set has now been installed as it had been found that this set could be erected in place of one of the existing 800-kw. reciprocating units. The extension unit comprises a 5000-kw., three-phase, fifty-period, 6600-volt turbo-generator running at 1500 r.p.m. and having an overload rating on emergency of 7500 kw.—London *Electrician*, June 18, 1915.

Birmingham.—An illustrated description of the Nechells temporary power plant of the Birmingham Corporation. It has a rated output of 10,000 kw. and comprises two 5000-kw. turbo-alternators, three-phase, 5500-volt, twenty-five cycles.—London *Electrician*, June 18, 1915.

Electrophysics and Magnetism

Radiations from Exploding Atoms.—ERNEST RUTHERFORD.—An account of a lecture before the Royal Institution in London. The radiations observed during the disintegration or transformation of a radioactive substance are of three types, known as alpha, beta and gamma ray changes. Some transformations are characterized by one type only. The alpha particle becomes a helium atom when deprived of its two positive charges; the beta particle is the same as the cathode-ray particle or electron. The alpha-ray is shot out at a speed of 10,000 miles per second; the speed of beta-rays approaches that of light. The gamma-rays resemble X-rays of a very penetrating character, and they have recently been identified with the characteristic rays of Barkla. The author finally discusses the connection between beta and gamma rays and their spectra. The phenomena involved comprise changes in frequencies and conversion of radiations.—London *Electrician*, June 11, 1915.

Self-Intersecting Lines of Force and Equipotential Surfaces.—G. B. JEFFERY.—By a theorem due to Rankine, if n sheets of an equipotential surface intersect at a point of equilibrium, they make equal angles π/n with each other. The object of this paper is to give some simple extensions of this theorem and some analogous results for lines of force. The author first considers the case of a two-dimensional field and shows that at a point where n equipotential lines intersect n lines of force will also intersect. Further, these lines of force make equal angles π/n with each other and bisect the angles between the equipotential lines. The author next takes up the case of a three-dimensional field having an axis of symmetry. At a point of equilibrium not lying on the axis of symmetry the intersecting equipotential surfaces make equal angles with each other. The lines of force also make equal angles with each other and bisect the angles between the equipotential surfaces. If the point of equilibrium lies on the axis of symmetry, these results are no longer true. The axis of symmetry is always one of the intersecting lines of force. There are $n-1$ others, making n lines of force which intersect at a point where n sheets of an equipotential surface intersect. These, again, will not make equal angles with each other, but one line of force will lie between every two consecutive sheets of the equipotential surface.—*Philos. Mag.*, June, 1915.

Units, Measurements and Instruments

Temperature Scale.—In the recent annual report of the (British) National Physical Laboratory it is stated that at the fifth general conference of weights and measures, held at Paris, October, 1913, certain resolutions were adopted as the result of which the National Physical Laboratory adopted as its fundamental scale of temperature the centigrade thermodynamic scale. In order to realize this scale conveniently with the highest accuracy, the hydrogen thermometer is used between 0 deg. and 100 deg. The platinum thermometer is used for other temperatures. The temperature T on the international scale is deduced from the resistance of the platinum thermometer by the formula

$$T - t_{pt} = \delta\left[\left(\frac{T}{100}\right)^2 - \frac{T}{100}\right]$$

where $t_{pt} = 100 \times (R - R_0)/(R_{100} - R_0)$, and R, R_0 and R_{100} are the observed resistances of the thermometer at temperatures T, 0 and 100 deg. respectively. The platinum of which the thermometer is made shall be of such degree of purity that the value of δ in this equation shall not be greater than 1.52 and R_{100}/R_0 shall not be less than 1.386. One of the features of the work on resistance thermometry during the year has been the installation of an equipment for use with platinum thermometers with potential leads. This type of thermometer has some advantages over the usual compensated Callender type, when employed at fixed temperatures which can be maintained sufficiently steady to allow the necessary commutations to be made, since under these conditions the resistance of the leads is totally eliminated. A study is in progress concerning the influence of constructional details on the indications of thermometers of various types.—London *Electrician*, July 2, 1915.

Telegraphy, Telephony and Signals

Directing Electromagnetic Waves.—ALEXANDER ARTOM.—An illustrated description of some forms of aerials for sending wireless messages in a certain direction. A simple form of aerial is that of Fig. 2, consisting of an isosceles triangle open at the summit. When the two branches of the aerial are fed by currents of opposite phase the diagram of dirigibility of the electric waves radiated is that shown in Fig. 3. The curves of dirigibility were determined by measuring the intensity of the radiation in the different directions by a Duddell thermo-galvanometer. These curves have the shape of two ellipses with common tangent, the greater axis lying in the plane of the triangular aerial, and of which the base of the triangular coincides with the common axis of the two ellipses. In other words, the radiation extends all along the direction of the plane of the radio-telegraphic aerial, on the right as well as on the left. In the direction perpendicular to the plane of the aerial the radiation is practically nil. Thus, to call to mind a practical example, in the direction of the plane of the aerial and in those near it radiotelegrams can be sent to a distance of 400 or more kilometers with the cost of energy inferior to that employed in ordinary radiotelegraphic stations, while in the direction perpendicular to the plane of the aerial and in that comprised in a fairly wide sector the radiation is practically nil, even at a distance of 1 km. The same triangular aerial used as a receiving aerial (Fig. 4) has identical properties with regard to the reception of wireless telegrams. This arrangement may be elaborated so that wireless telegrams may arrive exclusively

from determined regions, avoiding all possibility of being intercepted by apparatus situated outside the selected zones. A modified type of aerial is shown in Fig. 5. In this aerial the upper extremities of the triangle of the first diagram are bent back and put into communication with the earth by means of two con-

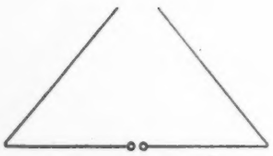


FIG. 2—A SIMPLE FORM OF WIRELESS AERIAL

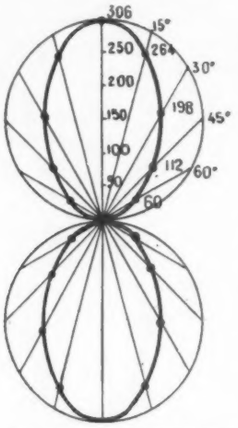
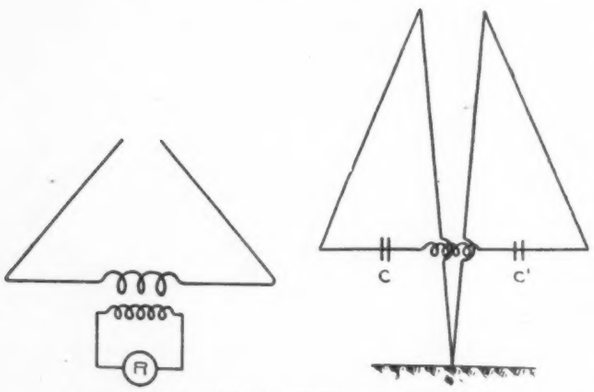


FIG. 3 — DIRIGIBILITY OF ELECTRIC WAVES

ductors. The receiving apparatus is connected by means of an inductively coupled circuit to the central part of the horizontal conductor. Like the aerial of the third diagram, it makes the receiving apparatus sensitive to the waves which arrive from the stations situated near the plane of the aerial, and it excludes the waves coming from the stations situated outside the plane of the aerial—London *Electrician*, June 25, 1915.

Wireless Telegraphy.—H. de Bellescize.—The first part of a mathematical paper on the efficiency which can be obtained from the arrangement of an alternator charging through a transformer the capacity of an exciting circuit coupled to an antenna. The author first discusses the succession of wave trains, the conditions



FIGS. 4 AND 5—TYPES OF AERIALS

of resonance, and the efficiency of the excitation circuit. —*La Lumière Elec.*, April 24, 1915.

Theory of Telephone Transmission.—F. Murphy.—The first part of a mathematical paper in which the author shows that the present theory, although sound so far as it goes, ignores one essential consideration, and by no means proves the commonly accepted law that the received speech over lines in which the attenuation is the same is equal. The truth of the law is, however, confirmed by experience. The article, which is of a mathematical nature, is to be continued in a subsequent issue.—*Post Office Elec. Engineers' Journal* (London), July, 1915.

Book Reviews

Elementary Mechanics for the Practical Engineer. By John Paul Kottcamp. New York: McGraw-Hill Book Company, Inc. 182 pages, 85 illus. Price, $1.50.

The material contained in this volume is that which comprised an engineers' study course of thirty lessons in *Power*. It is not, nor is it intended to be, an exhaustive treatise on elementary mechanics; instead, the avowed purpose of the author, and the plan to which he has adhered, is the statement of those fundamental principles of mechanics that underlie the operation of power-plant machinery, and in which, therefore, the operating engineer is most deeply interested. The treatment of the subject is clear and simple, and the suspicion of heaviness and dryness that usually clings to a work on mechanics is avoided by illustrating the application of the various laws and principles, and the illustrations are so chosen as to involve machines and apparatus with which the engineer is in daily contact. The selection of such illustrative examples as these naturally makes the subject matter more interesting and easier to grasp than if it consisted of bald statements of abstract principles. Each lesson is supplemented by a series of five study questions, which are problems designed to test the ability of the reader to apply the principles explained in the lesson, and the answers to these questions are also given. The book should prove of value to the practical engineer who wants to understand the why and the wherefore of many of the operations that take place in the plant where he may be employed.

Dynamometers. By Rev. Frederick John Jervis-Smith, M.A., F.R.S., edited and amplified by Charles Vernon Boys, F.R.S. New York: D. Van Nostrand Company. 268 pages, 119 illus. Price, $3.50.

The power output of prime movers or the power transmitted by shafts that are used to drive machines or to propel vessels is a quantity that must be known in order to determine the efficiency with which the work is done or the amount of energy required for the performance of the work. Such data, which are of vital importance in connection with the economical operation of all classes of machinery, are obtained by the use of dynamometers. These are of many forms, depending on whether the power to be determined is that produced by a motor of some kind or that transmitted from a motor to a driven machine; also, the magnitude of the power to be measured has considerable bearing on the design of the dynamometer. This volume describes the various forms of brakes used as dynamometers, in which the resistance is caused by friction, water, air, or magnetism; the methods of dissipating the heat due to friction; power-measuring machines depending on the amount of torsion of a transmission shaft, and the application of dynamometers to steam engines, motor-car engines, high-speed internal-combustion engines, electric motors, ships' models and aeroplane propellers. There are two introductory chapters devoted to a discussion of friction and its measurement and forms of planimeters or mechanical integrators. The book is for the greater part descriptive in character and covers well the field of dynamometry, with the exception of that particular type so extensively used in railway service known as the drawbar dynamometer. In addition to the descriptions given, there are many references to articles, papers and books on dynamometry and allied topics, forming in the aggregate a copious bibliography of the subject.

POWER AND OPERATING SECTION

Waste and Trouble Preventives

IT sometimes happens that the energy required to drive industrial-plant equipment increases without a corresponding increase in the output of the plant. Seldom is this due to recording errors of meters, but it is caused by wastes usually made up largely of friction losses in machine bearings and in line shafts. Adjusting screws may work loose in line-shaft hangers and throw the shaft out of line; sometimes a bearing cap gets loose and the oiler in tightening it draws up too hard on the bolts, or possibly driving belts are unnecessarily tight. A poor lubricant may also increase the friction, especially if the purchasing department tries to economize on this important supply. These kinds of causes are the hardest to locate and are sure to increase operating expenses considerably if not corrected. Daily records properly kept show up such wastes as they develop and are money savers and trouble preventives in every kind of plant.

Operating Chain Grates

THE mechanical stoker is now used in both large and small plants and has proved sufficiently flexible in operation to accommodate itself to variable-load conditions. A change of load on a boiler fired by a mechanical stoker is met in the same way as in a hand-fired boiler, namely, by increasing or decreasing the rate of combustion and therefore the rate of evaporation; but a change in the rate of combustion involves something more than a mere alteration of the speed of the engine or motor that is used to drive the chain grate. If the travel of the grate is accelerated and the coal fed to the grate at the same depth as before, the combustion of the fuel must take place in a shorter time than before the change in the rate of speed, and as a consequence the amount of air supplied will need to be increased. It will not be necessary to increase the pressure of the air supply, for the thickness of the fuel bed, and therefore the resistance to the passage of the air, remains unchanged. The quantity of air supplied must be increased, however, in direct ratio to the increase of speed of the grate, to insure continuously efficient combustion. The burning of a greater amount of coal in a stated period, with an increased air supply, means that the quantity of hot gases produced will be much greater. As a consequence, the chimney will be called upon to perform greater work and the travel of the hot gases over the boiler surfaces will need to be accelerated, in order to remove the greater quantity in the same time as before. On the other hand, if the movement of the grate is left unchanged, but the fuel is fed on to it more rapidly, the depth of the fuel bed will be increased and the resistance to the passage of air through the burning coal will be greater, necessitating a stronger draft or an increased pressure beneath the grate, depending on the method of furnishing the air supply. The draft and the quantity of air cannot always be adjusted with the desired precision, and in such a case there is danger of fuel waste. If the air supply is too great, the products of combustion will be diluted, their temperature lowered, and their heating properties decreased. If the air supply is too small, the combustion will be retarded and some of the unburned fuel will be carried over the end of the grate and thrown into the ash pit. In order to obtain the best results from combustion, these factors must be carefully considered and the proper adjustments during operation made.

Taking Things for Granted

IN the desire to lessen accidents the operation of many power plants has become hedged about by codes of rigid rules and regulations. Although there are some who feel that the advocates of safety-first principles have gone to extremes in the matter of trying to eliminate danger, it cannot be denied that there is ample excuse for the exercise of all precautions. The necessity for care in power-plant work does not arise wholly from ignorance, however, for thoughtlessness and lax investigation are prolific causes of accidents. If any doubt is entertained as to the part played by carelessness in producing casualties, it will speedily be dispelled by reading the accounts of investigations made to determine the causes of accidents to boilers, engines and other parts of plant equipment and of injury to workmen engaged in operating them. It is important to realize that human life and plant machinery are far too valuable to be jeopardized through carelessness and neglect. There are a hundred and one matters in the daily operation of a plant that the easy-going engineer may take for granted, but he safeguards both himself and the machinery in his charge, and reduces the chance of accident to a minimum, if he refuses to be satisfied with anything except authentic information concerning the condition of the equipment in his plant.

When a High Vacuum Means Something

IN recent years engineers have taken an active interest in reducing the cost of production in all industries, and attempts have been and are still being made to discover set rules which, when taking into consideration the local conditions, will show where the reduction can be made. Numerous appliances and methods have been resorted to which have tended toward economy in

the modern power plant, with more or less success, largely in the direction of showing that to save money in most plants some money must be spent to bring about conditions under which economical operation is possible. One such proposition that is of interest during summer time is a system for cooling, or rather recooling, the water required in power and refrigerating plants.

In the case of a condensing steam plant where water is purchased or pumped from wells at a certain fixed expense, the cooling system not only effects a reduction of the water bill but improves the operation of the condensing outfit during the hot months of the year, for the temperature of the water used in a condenser has a decided effect on what it will do as compared with what is expected of it in reducing the back pressure on the steam unit to which it is connected. In general, it is desirable to use as low a back pressure on engines and turbines as other conditions will permit, but in securing the best vacuum due regard must be given to all operating features. For instance, the average load that can be put on a plant in comparison with the rated capacity of its apparatus and the length of time at which such apparatus can be operated at its best efficiency are important considerations in determining the vacuum best suited for any station, since the fixed charges on equipment must be taken care of whether the plant is operating at full or at low load, or not at all, while the gain due to vacuum is realized only when the engines and turbines are in operation and at best efficiency. The higher the plant factor and the longer all units are in operation, the better the conditions are for the reduction of operating costs and the more important are refinements in operation.

The steam engine shows slight improvement in operation due to increase of vacuum beyond 26 in., for this seems to be about the point where improvements in steam economy fail to exceed the increased power required by the auxiliaries. With the steam turbine, however, there is a possible reduction in steam consumption of from 3 to 4 per cent for each inch increase of vacuum between 26 in. and 29 in., with a small increase more effective between 28 in. and 29 in. than between 26 in. and 28 in. Where fuel is relatively expensive, ample cooling water available only by pumping from uncertain wells, and city water expensive, with plant factor fairly high, conditions are most favorable to refinements in securing a high vacuum, and important among the methods to secure this is an arrangement for recooling condensing water. How far the expense of cooling may be carried and how it may be brought about will depend, first, upon the physical and geographical location of the property, and, second, upon an engineering consideration of the charges against the combined condensing and cooling systems such as interest, depreciation, attendance and repairs, balancing these factors against the saving in fuel plus the saving in water made possible. In medium-sized turbine plants the use of higher superheats, higher steam pressures and easily maintained vacuums are producing excellent results and are making new standards for steam-plant operation.

Changing Views on Motor Drives

A well-known expert in machine-shop practice made the statement about five years ago that if a three-to-one adjustable speed motor with no greater variation than 4 per cent in any part of its entire range of speeds and loads materializes, a great step will have been taken toward the millennium of the machine-shop engineer vitally interested in cutting speeds. This step has now become a matter of history, and adjustable-speed motors with speed ranges of four to one, now so common, have variations little or no greater than those set above.

A canvass of the situation among users and manufacturers of motors for machine-tool drives indicates, however, that there are still to be found conflicting opinions on the advantages of the motor-driven machine. One machine-tool manufacturer, for example, has gone so far as to state that all late designs have a belt-connected motor drive in preference to a gear-connected motor drive, this reference being rather to the method of connection than to the manner of drive. Another advances the idea that in no known instance is it possible with modern machines to secure any greater output by reason of the fact that the motor is self-contained in the machine instead of driving through a countershaft.

These opinions may be contrasted with others also from machine-tool builders. In one case the statement is advanced that a combination of motor drive and high-speed steel has without doubt had a tremendous effect in improving the efficiency of machine tools. Another says that in specifying new machinery motor drive is selected for the reason that it gives to the equipment a flexibility and a freedom from transmission troubles, together with an openness to the roof space of the shop, which is obtainable in no other way. Still another states that the comparative production of machine tools equipped with motor drives and belt drives in its plant is evidenced by the fact that of the last lot of machines sold 86 per cent were motor-driven and 14 per cent belt-driven.

These varied opinions, when properly analyzed in terms of conditions now existing, tend to point to the conclusion that a remarkable change has come over the industrial-motor field within a comparatively brief interval. The situation is somewhat complicated, when an effort is made to secure a common acceptance of the superiority of motor-driven machines, by the depreciation factor, which in many cases makes it impracticable to discard old shaft-driven machines for new equipment, and at the same time by the difficulties encountered in a change from belt to direct-motor drive in some types of old machinery. Taken as a whole, however, existing practice points to the availability of motors which possess practically ideal characteristics for machine drive. Undoubtedly, as new machines replace old equipment in the shops throughout the country, because of the normal deterioration of the old equipment, the attitude toward the specific advantages of motor drive will become more general not only on account of direct economies but also owing to numerous indirect advantages which commend it to modern shop methods and arrangements.

Operating Features of a Small Plant

Details of Power-Plant Layout, Operating Conditions, Condensing Arrangements and Motor Service

IN the manufacture of paint there are many processes, such as pumping, grinding and mixing, that furnish conditions most favorable to the use of electric motors. In the case of the C. A. Willey Company, Long Island City, N. Y., manufacturer of carriage paints, a small steam-electric plant has been installed to furnish the electrical energy used. This plant equipment is situated in a building detached from those used for manufacturing purposes and is of the Corliss steam-engine type. The boilers and engines have been installed where they will not interfere with future additions. The piping arrangements are such that the exhaust steam from the engine and auxiliaries may be delivered to a vacuum heating system or a condenser for the economical use of steam. No. 1 pea coal, at an average cost of $4.20 per ton delivered, is used as fuel and stored in a bin holding about 150 tons. The daily consumption is about 2.5 tons.

Boiler-Room Equipment and Method of Handling Fires

Three 150-hp. Dillon fire-tube boilers operating at 100 lb. pressure and no superheat are installed and are hand-fired from a hand wagon with a side pocket. Three-section, double-action eccentric-motion Yingling shaking grates having an area of about 39 sq. ft. are employed. As the grate bars are level, a shallow fire may be maintained with little danger of airholes occurring. These grates consist of 0.5-in. by 6-in. interlocking fingers, alternate ones being connected with the same actuating bars. When the grates are shaken the fingers rock in opposite directions, cutting out the ash and clinkers without disturbing the coal above. Fifty-five per cent of the grate's area is air space, but the openings are small so that fine coal can be burned without waste. The grate is set on a frame supported independent of the boiler setting.

The fires are kept about 6 in. deep and shaken every two or three hours. When the coal bed shows any signs of clinkers a T-iron is balanced on the dead plate and allowed to fall on the fire to break up the clinkers and leave them in a condition to be shaken out through the grates. In this way the ashes do not mix with the coal and cause more clinkers. Slice bars are not required in loosening the fire as rocking of the grates serves the same purpose. Ashes are stored outside the building and removed by wagons.

Once a week the fire tubes are blown out, and about once a month a scraper is run through them to remove scale. About 1 pint of Booth's "Eureka" vegetable scale eradicator is fed into each boiler every day, and so far no scale has collected on the water-surface side of the tubes or drums. The boilers are blown down only once every two weeks to avoid using more boiler compound.

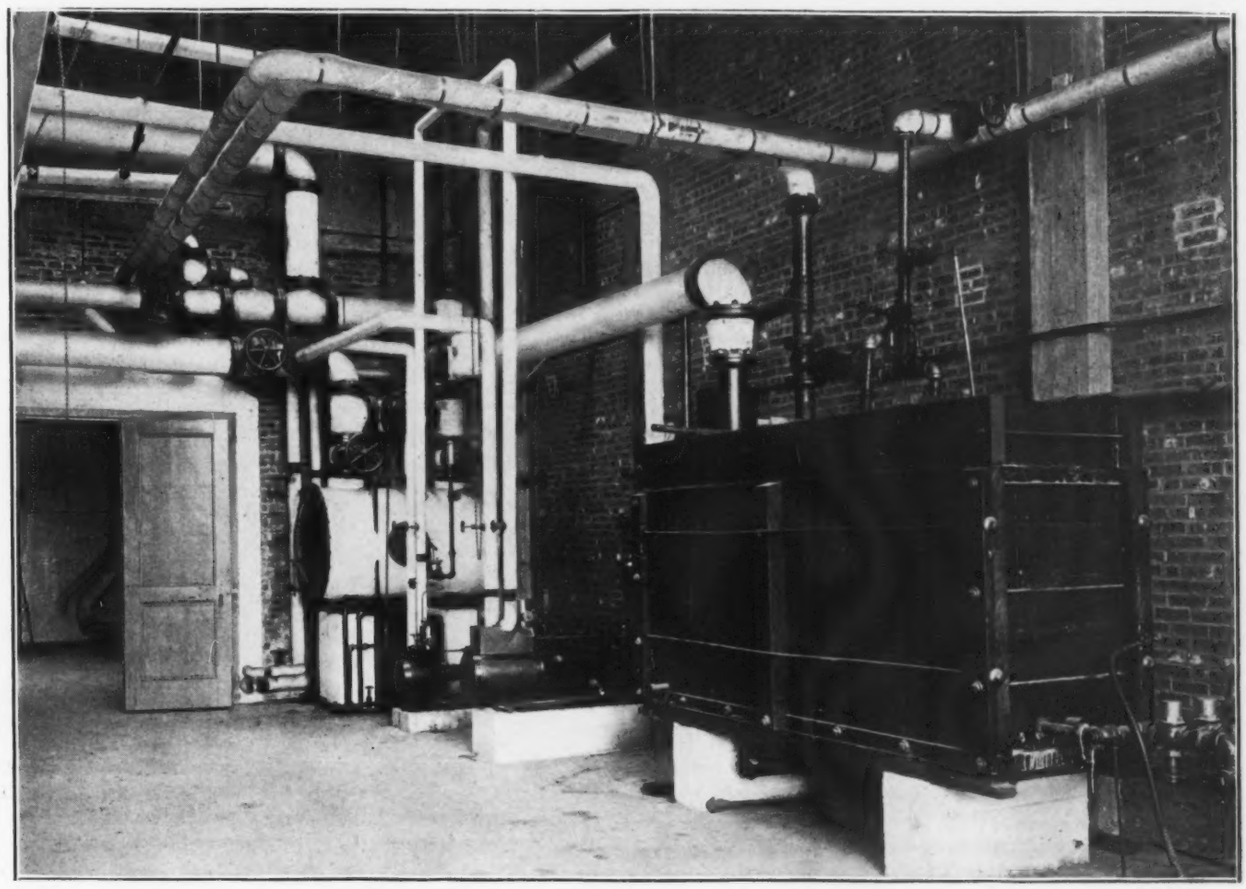


FIG. 1—HEATER ROOM OF C. A. WILLEY COMPANY'S PLANT, SHOWING SPECIAL CONDENSER AND A FEED-WATER HEATER

Smoke is discharged from the boilers at the front into a tapered flue leading to a brick stack. At the small end of the flue and between the last boiler connected thereto and the stack are tightly fitted doors giving access to cleaners. The chimney has an internal diameter of 8 ft. at the bottom and is 150 ft. high. The draft is automatically regulated by a Thompson damper con-

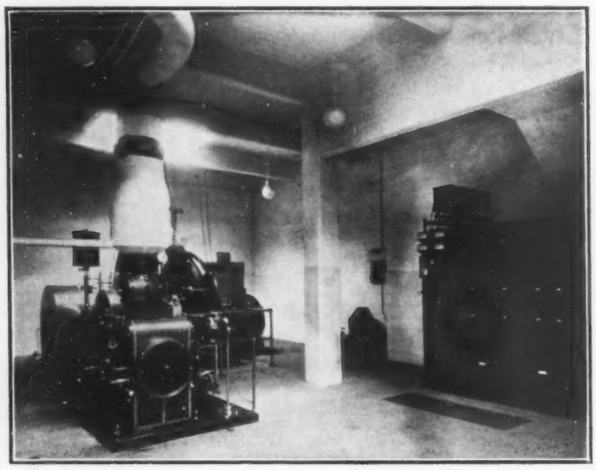


FIG. 2—HAMILTON-CORLISS ENGINE DRIVING A 220-KVA., TWO-PHASE GENERATOR

troller, which depends for its action on the steam pressure. The device consists of a diaphragm valve connected with the steam header and acting on a weighted lever pivoted at one end. This lever operates another lever connected with a pilot valve which admits water to a hydraulic plunger connected with still another lever operating the damper. The apparatus will stop the movement of the damper as soon as the pressure is restored to its normal value of 90 lb. The hydraulic piston is lubricated by placing a piece of soap in a pocket in the water-supply line. A draft gage is connected with the smoke flue.

A Linton combined feed-water heater and oil separator is employed, and its connections with the exhaust-steam line, condenser, etc., are shown in the accompanying line drawing. The amount of make-up water supplied to the feed-water heater is automatically regulated by a float attached to the water-inlet valve lever. The feed-water pump draws its supply of water from the feed-water heater and an elevated tank which receives condensate from the heating system and condenser.

The boiler-feed water is supplied through 2-in. extra heavy brass piping. Brass pipes of 1¼-in. diameter connect with a Wright safety water column equipped with high-and-low-water alarm. The water column cocks are opened by chain pulls but are closed by gravity. For regular service a Foster steam-driven reciprocating pump is employed for pumping the water, but a Pemberthy injector operating on 1½-in. suction is provided for emergency purposes.

An open-tank type of surface condenser, shown in Fig. 1, designed and built by the company, has been found to work very satisfactorily. As shown in the section Fig. 5, a tank about 9 ft. long, 5 ft. high and 3.5 ft. wide, made of 3-in. wood strengthened by 0.5-in. iron tie rods, contains the cooling water. Supported horizontally in the top of the tank several inches below the surface of the water is a 6-in. header which is connected by means of seventy 1.5-in. brass pipes with a horizontal grill of connected pipes in the bottom of the tank. The construction of the condenser is shown in an accompanying drawing. Exhaust steam from the engines and auxiliaries, after it has passed through the feed-water heater, enters one end of the condenser header as shown. The condensate leaves at the opposite end of the tank from the lower horizontal pipe grill.

Cooling water is delivered to the tank by a 4-in. pipe which discharges about 1 ft. above the bottom. This arrangement permits the cold water to spread. As it is heated by condensing the steam it rises to the top and discharges through a 4-in. overflow pipe. About 85 gal. of water at 50 deg. Fahr. is used per minute to maintain a 10-lb. vacuum with a load of 50 kw. on the plant.

The cooling water used is pumped from wells to grinding machines for cooling and then to the condenser so that its temperature is considerably lower than it would otherwise be. A better vacuum could be maintained if water direct from the well outside the plant were delivered at 150 gal. a minute, which is the rate for which the condensers were designed. Water pipes direct from the wells are connected with the condenser, however, for use when the load is heavy. The condenser was designed to handle all of the exhaust steam which would issue from the Corliss engine when loaded to 300 hp.

Steam Piping and Engines

The steam generated in the three boilers is carried to a 10-in. steel header equipped with Vanstone flanges and situated at the rear of the boiler. The header is peculiar in that it is made up of T's connected end to end so that steam may be taken off the ends or top of the header. Three of the T's are connected with the boilers, one with the Corliss engine, two with auxiliary pumps and one through a reducing valve with the heating system. The T's which are not used are capped but arranged so that other steam connections can be made as the plant grows. Drains tapped into the bottom of the header lead to a steam trap which returns the condensate to the boilers through the feed-water heater.

Each boiler is equipped with a Crane automatic stop valve which will close automatically in case the flow of

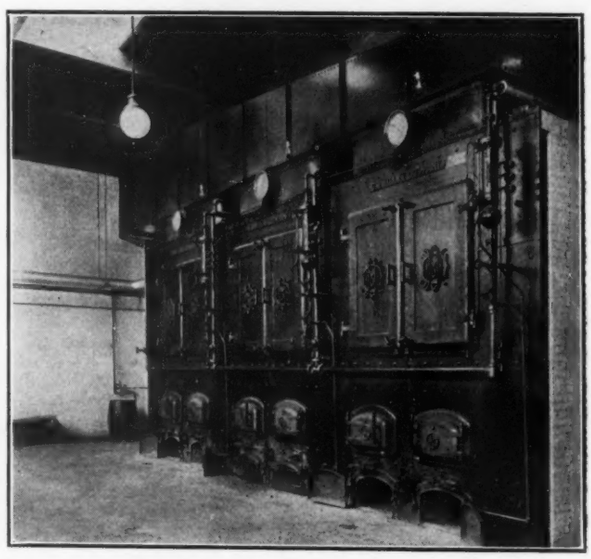


FIG. 3—THREE 150-HP. FIRE-TUBE BOILERS EQUIPPED WITH HIGH-AND-LOW-WATER-ALARM COLUMNS

steam becomes so excessive as to endanger the boiler. Two safety valves set at 130 lb. pressure are used on each boiler, their exhausts being connected with a common header discharging into the atmosphere. These valves are tested by hand each day to be certain that they are in working order.

Exhaust steam is used for industrial purposes and in

cold weather for heating. The surplus is delivered to the open-tank condenser previously described. The condensate from the condenser and the heating system is returned through separate pipes to a vacuum pump. Differential valves set for a 6-lb. vacuum are used in the heating-system return and valves set for 7-lb. vacuum in the condenser return to prevent all exhaust steam being drawn through the latter. Water used in the plant for condensing purposes is obtained from a 200-ft. artesian well with a motor-driven Luitwieler deep-well pump rated at 125 gal. a minute. All cooling water is discharged into a sewer after being used. A 6⅛-in. by 9-in. by 10-in. steam-driven reciprocating pump is connected with the condenser and with the vacuum system of steam heating.

Engine-Room Equipment and Lubricating System

The steam engine is installed in a room to the rear of the boilers, and is an 18-in. by 36-in. Hamilton-Corliss design running at a speed of 120 r.p.m. Directly connected to this engine is a 220-volt, two-phase, sixty-cycle, 200-kva. General Electric alternator with direct-connected exciter. Any moisture which may accidentally be carried over in the main leading to the engine or may collect there from condensation is removed by a steam separator just above the throttle. The latter is specially designed so that it can be easily opened and so that the first turn of the valve stem will not allow steam to flow too abruptly. This is made possible by a circular plate on the valve stem covering holes in the valve disk. The first few turns of the valve stem uncover these holes, allowing steam to enter the engine and thus equalizing the pressure on opposite sides of the valve disk so that it will open easily.

The Richardson-Phenix system of oiling is used for the engines and pumps. A drain tank is provided in the corner of the wheel pit of the engine to which all oil drains are connected, and a small pump connected to the eccentric of the engine pumps the oil from the drain tank to a combined filter and storage tank situated a few feet above the top of the engine.

Switchboard and Electrical Layout

The station switchboard in the engine room has switching provisions so that emergency central-station service may be quickly established by opening the machine switch and closing the central-station service switch. A curve-drawing wattmeter, a voltmeter and an ammeter for each phase and kilowatt-hour meters for lighting and power service are installed, as well as hand-operated rheostats for regulating the alternator's voltage. No automatic regulation is provided.

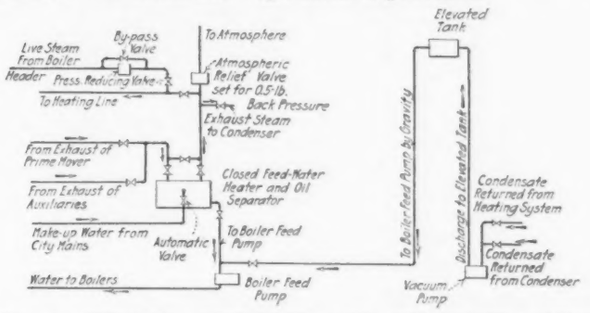

Elevated Tank
Live Steam From Boiler Header
By-pass Valve
To Atmosphere
Press. Reducing Valve
Atmospheric Relief Valve set for 0.5 lb.
To Heating Line
Back Pressure Exhaust Steam to Condenser
From Exhaust of Prime Mover
From Exhaust of Auxiliaries
Closed Feed-Water Heater and Oil Separator
Make-up Water from City Mains
Automatic Valve
To Boiler Feed Pump
To Boiler Feed Pump by Gravity
Discharge to Elevated Tank
Condensate Returned from Heating System
Condensate Returned from Condenser
Water to Boilers
Boiler Feed Pump
Vacuum Pump

FIG. 4—EXHAUST, CONDENSER AND FEED-WATER PIPING

Separate feeders are installed for power and lighting service, the main building being divided into east and west sections in both cases, each section having its own feeders. Separate power and lighting feeders also lead to the varnish department, which is situated in a different building from the main paint works. In the main building, which is six stories high, a separate feeder is used for operating each of the two elevators.

The accompanying table gives the number and sizes of motors installed, all motors being of the two-phase induction type. Condit starting switches are used in all cases except that of the 15-hp. motors installed in the grinding department, where General Electric starting compensators are used. The motor drives are of particular interest in that chains are employed between the motors and the line shafts, and also between the line shafts and the machines driven by them. These chains were installed in order to maintain constant speed, the experience of the company being that the slippage of belts caused serious variations in the speed of the grinders.

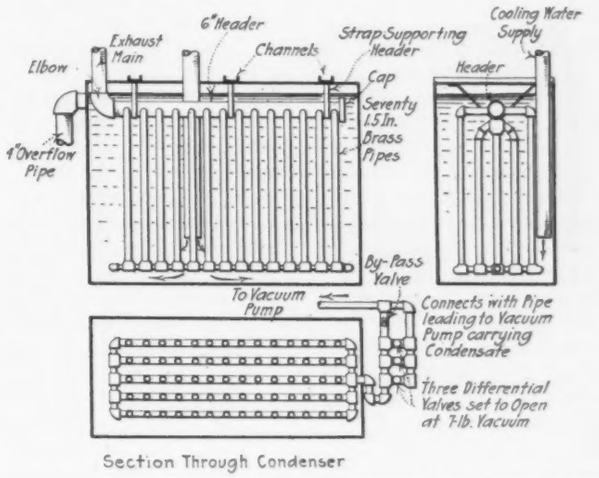


FIG. 5—CONSTRUCTION AND OPERATION OF HOME-MADE CONDENSER

MOTORS INSTALLED AND MACHINES DRIVEN IN A PAINT FACTORY

Floor	Motors		Machine Driven
	No.	Hp.	
Sixth	2	5	Chain-connected to line shafting.
	1	3	Directly connected to fan blower.
Fifth	1	2	Belted to varnish pumps.
Fourth	2	5	Chain-connected to line shafting for mixing machines.
	2	2	Chain-connected to line shafting for mixing machines.
	1	3	Belted to line shafting for auxiliaries.
Third	6	15	Line shafting for grinders, chain-driven.
	2	3	Chain-connected to line shafting for mixers.
Second	1	3	Line shafting in machine shop, chain-driven.
	1	1½	Printing machine.
Basement	1	3	Pump for water tanks.
Varnish department	1	5	Chain-connected to line shafting for pumps etc.
	1	3	Chain-connected to line shafting for pumps, etc.
	1	2	Directly connected to blower.

Station-lighting arrangements include a 220-110-volt distribution system. The motor load is uniform, being about 90 kw. from 7.30 a. m. to 5.30 p. m. The plant does not shut down at noon. From the records made by the chief engineer 2585 kw-hr. of energy has been produced with 4026 lb. of coal and 5695 cu. ft. of make-up water. The make-up is larger than it would be if the condenser were taking more of the exhaust steam so that none would escape through the atmospheric exhaust. The amount of lubricant used during the period to which the above records refer is as follows: Five pints of engine cylinder oil, 2 pints of pump cylinder oil, 8 pints of engine-lubricating oil.

Getting the Proper Vacuum in Summer

Economy of Proper Vacuum, Characteristics of Cooling Systems, Their Operating Requirements, and Considerations in Selecting Designs

BY J. WILMORE

THERE are two distinct methods of cooling water for continuous re-use after it has been heated through a cycle of operations. These are usually distinguished as natural and mechanical systems, and include various types of so-called cooling ponds, cooling towers, and the more recent form of rotary water cooler.

Well-designed systems of this character have practically always proved a profitable investment, especially when applied to gas and oil engine plants, steam-engine and turbine equipments and refrigerating apparatus, since an abundant supply of cold water is essential to the efficient operation of each of these types of installations. Some plants are so situated as to be able to take water from a river, whereas others resort to driven wells, but many power stations must of necessity use city water, which, on account of the quantity required and conditions governing the supply, is an expensive operating item. This is one of the reasons for so many non-condensing steam-power plants throughout the country.

The fuel economy effected by operating a steam plant condensing instead of non-condensing may vary from 15 per cent to 25 per cent with a suitable condensing equipment and an adequate water supply. With an unlimited supply of well water not always available and city water expensive, it is certainly poor economy to waste water to the sewer in a condensing plant. Hot water may be used over and over again, however, if passed through a cooling system where the heat is extracted and absorbed by the atmosphere. There will be a resultant small loss due to evaporation and other causes, varying from 1 per cent to 5 per cent, and this quantity of fresh water must be added to maintain the circulation of the constant quantity required. This auxiliary supply intended to make up the losses is the measure of the water which must be purchased or pumped from a well while the plant is in operation.

Economy of Proper Vacuum

The importance of using water at as low a temperature as practicable in connection with condensing steam-electric plants may perhaps be emphasized by referring to a steam-turbine plant where high vacuum is essential to efficiency and requires the use of relatively cold condensing water. Under ordinary climatic variations, the approximate relation between a given vacuum and the temperature of condensing water necessary to maintain it is given in Table I, and by the utilization of a commercial type of cooling system a vacuum of 28 in. may be readily obtained during all months of the year.

TABLE I—CONDENSING WATER REQUIREMENTS FOR TURBINES

Vacuum, Inches Mercury	Corresponding Steam Temperature, Deg. Fahr.	Temperature Difference, Steam and Cooling Water, Deg. Fahr.	Required Temperature Cooling Water, Deg. Fahr.
26.0	124	30	94
26.5	120	30	90
27.0	114	25	89
27.5	107	25	82
28.0	100	20	80
28.5	90	20	70

The economy of condensing operation at a high vacuum is clearly shown in the curve of Fig. 1. By referring to the scales of this diagram, the approximate saving in fuel at any vacuum as related to the fuel consumption at 26 in. may readily be determined. Thus by using condensing water of 82 deg. Fahr., representing a gain only of 1½ in. of vacuum, the coal consumption is reduced 7 per cent over running with a 26-in. vacuum.

Water-Cooling Systems

The natural systems available for re-cooling condensing water include the atmospheric cooling pond, atmospheric cooling tower, and the natural-draft tower. The mechanical means are the spray pond, forced-draft cooling tower, and rotary water coolers. The operation of these different systems is subject to the climatic variations; however, the mechanical apparatus is susceptible to a certain degree of control as regards cooling effect. All of the systems depend upon air in reducing the temperature of the water, the reduction being caused mainly by evaporation and convection or the contact of the water with the ascending air currents and partly by radiation.

Evaporation is the most important factor in the cooling of the water, for as surface water passes from a liquid to a vaporous state considerable heat is given up to the atmosphere. This heat is not sensible to the thermometer and is known as the latent heat of vaporization. The process affects only the surface of liquids,

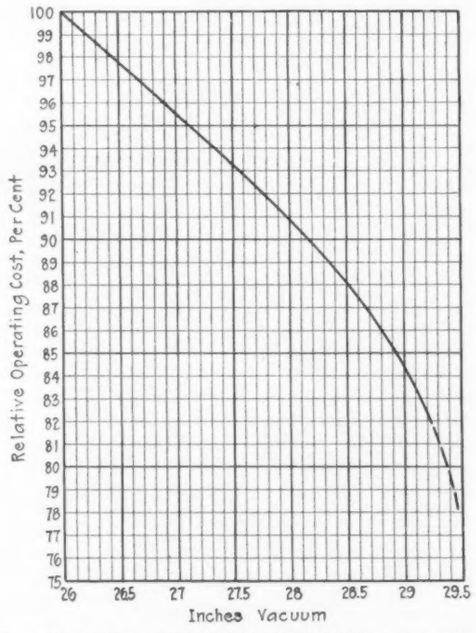


FIG. 1—RELATIVE OPERATING ECONOMY AT DIFFERENT VACUUMS

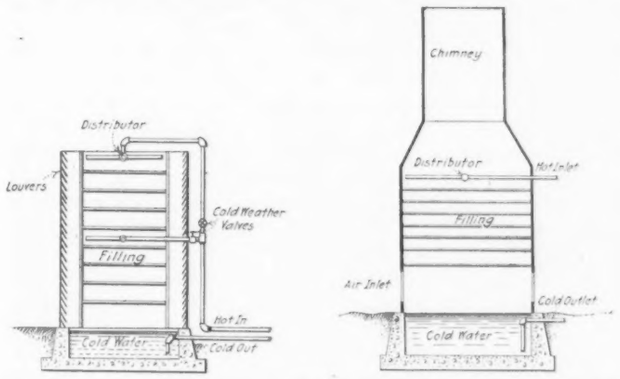
and this to a greater degree near the boundaries, so that the quantity of water vaporized is limited by the extent of the exposed surface. Evaporation increases with the temperature and decreases as the air becomes saturated, so that the greater the quantity of air in immediate contact with the water, the more rapid the evaporation.

Dry air at a given temperature absorbs moisture very

rapidly at first, but the rate of absorption of water by the air is gradually diminished as it becomes saturated. When that stage is reached it will hold no more moisture, but if the air temperature is raised more evaporation can take place. Thus, 1 cu. ft. of dry air at a temperature of 110 deg. Fahr. will absorb 26.11 grains of moisture, and dry air at 80 deg. Fahr. will absorb only 10.93 grains per cubic foot, representing complete saturation. Then, if the saturated air at 80 deg. Fahr. were heated and the temperature increased to 110 deg. Fahr., it would be capable of absorbing 15.18 grains more moisture for each cubic foot of air.

Complete saturation is equivalent to 100 per cent humidity, or the temperature of the wet-bulb thermometer for these conditions as well as the dew point, the former being the limit to which water may be cooled by the elements. However, normal air is usually only partly saturated, and the ratio that the amount of moisture present in the air at a given temperature bears to the maximum possible amount at the dew point is termed the relative humidity and is expressed in percentage. Table III shows the relative humidity for various localities, together with the mean temperature, both being for the month of July and representative of conditions when a cooling system is usually taxed to the limit of its capacity.

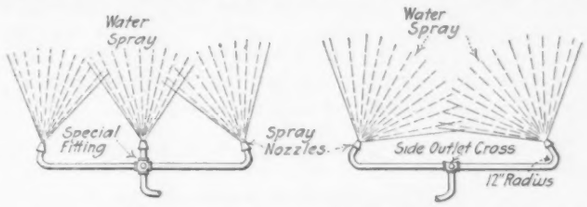
Where land values are low and space available the



FIGS. 2 AND 3—SHOWING MAIN OPERATING FEATURES OF ATMOSPHERIC AND NATURAL-DRAFT COOLING TOWERS

most economic means of re-cooling hot condenser water is by the use of an artificial pond or basin designed to receive the discharge water, which is there left to the effects of the atmosphere. Such reservoirs need not have a water line in excess of 3 ft., measuring from the bottom, unless additional water-storage capacity for other purposes is desired, for the cooling effect by evaporation takes place only at the surface. Of necessity, such ponds must be of large area so as to expose a large water surface to the air. By allowing about 70 sq. ft. of surface for each gallon to be cooled per minute, a suitable size of pond may be proportioned. While such a method of cooling is not extensively resorted to for plants of average size, for small plants this form may not be out of place as the roof space may be utilized by transforming it into a basin to hold the water, care being exercised that the location selected, whether on or above the ground, is such that adjacent buildings do not interfere with the free circulation of air.

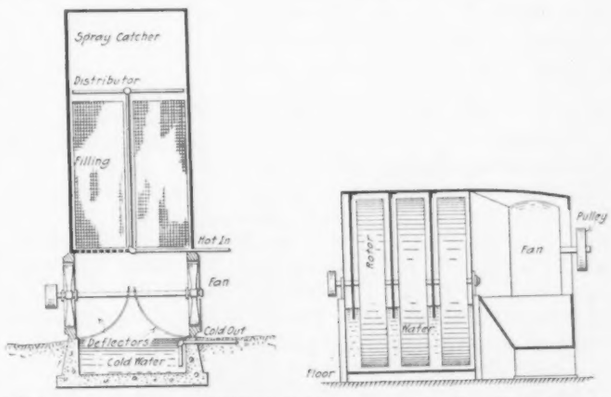
The atmospheric cooling tower, like the atmospheric pond, is dependent entirely on atmospheric conditions, and therefore occupies a relatively larger ground area than other forms of cooling towers. About 1.5 sq. ft. for each gallon of water per minute is required for the accommodation of this type of re-cooler, and its height when on ground level is about 30 ft. As the name implies, it is a tower-like structure made of either steel or wood, or both, and is entirely open to the atmosphere except that in some makes the sides are protected with louvers to save any drift that may otherwise be carried off by the prevailing winds. It is usually composed of a series of superimposed trays or troughs which contain the water and form the water-cooling surfaces exposed to the action of the elements. These decks are



FIGS. 4 AND 5—TYPICAL ARRANGEMENTS OF SPRAY NOZZLES FOR COOLING POND

made up of narrow strips of lumber or special patented forms of iron, resulting in a checker work or zigzag arrangement with openings at regular intervals for the distribution of the water from one level to another. These cooling surfaces are usually called the filling of the tower, and they vary only in details of construction, which, however, is an important feature to obtain permanent and substantial structures.

With the cooling tower the hot condenser water is pumped to the top of the tower, the delivery pipe terminating with several branch outlets for the even distribution over the top trough, and the branch pipes being fixed and perforated or caused to revolve about a central delivery pipe by the reaction of the jets of water issuing from one side of each pipe. The water drips down to the next level either in films or sheets of water, sometimes as fine as spray, according to design, until the bottom is reached, when the cooled water drains into a tank or reservoir from which it is pumped or fed by gravity to the condenser, according to the elevation of the tower. During the cold-weather season it is sometimes desirable to use only a part of the cooling surface of the tower in order to prevent freezing. This may be accomplished by confining the water distribution to only a portion of the top deck, or by providing another distributer at an intermediate level with valves so that the upper portion may be shut off. The atmospheric tower is shown diagrammatically in Fig. 2.



FIGS. 6 AND 7—SHOWING MAIN OPERATING FEATURES OF FORCED-DRAFT TOWER AND ROTARY WATER COOLER

The natural-draft cooling tower, sometimes called the chimney type of tower, is an inclosed structure, in design similar to the atmospheric tower, except for the different arrangement of the distributer and the cooling surfaces, which vary with towers made by different manufacturers. As shown in Fig. 3, the air is admitted around the base only, rising at a low velocity on account

of the upward chimney effect. Owing to the chimney action this type of tower requires approximately only about 1 sq. ft. of ground area for every gallon of water cooled per minute.

The spray pond is merely a pond or reservoir, not unlike the atmospheric pond, but in addition has an arrangement of spray nozzles over and above a catch basin. The discharge capacity that may be expected of a nozzle equipment varies with the pressure applied, which may be as low as 3 lb. or as high as 15 lb. However, for all practical purposes, with an appropriate size of spray nozzle, satisfactory operation may be

TABLE II—CAPACITIES OF SPRAY NOZZLES

Size, In.	Discharge, Gallons per Minute		
	5-Lb. Pressure	8-Lb. Pressure	10-Lb. Pressure
1.5	15	18	21
2.0	40	50	60
2.5	70	80	90
3.0	120	130	140

secured by operating nozzles at about 8 lb. to 10 lb. pressure during hot weather and at 5 lb. pressure during the cold-weather period. For every pound of pressure with which the hot water is forced through the nozzles a vertical rise of water of 1 ft. may be expected. The capacities in gallons per minute at various operating pressures are given in Table II. The cycle of operation is as follows: The hot condenser water is delivered either to a hot well or pumped directly through a piping system connecting the nozzles, which are usually placed 2 ft. to 5 ft. above the pond. The water is discharged in a fine, evenly distributed spray and a large water surface is thus exposed to the air. This system relies on climatic action, but the water issuing from the nozzles creates a draft and thus adds to the natural air circulation. The spray naturally falls within the shallow pond, and the cool water is then returned to the condenser. Catch basins or ponds for spray equipment need not be more than 2 ft. or 3 ft. deep, and an allowance of 2 sq. ft. of ground area for each gallon to be cooled will usually be ample.

There are two common arrangements for setting spray nozzles for efficient operation, but usually any such disposition is dependent on the size and shape of the space available for this purpose. If the space requirements above given cannot be met, the pond or basin, whether on the ground or roof, should be inclosed by suitable louvers so as to save any drift that might otherwise be carried off by the prevailing winds.

Typical arrangements call for a grouping with the nozzles set at an angle and pointing inward. Usually there are four horizontal arms branching out radially with the nozzles set at an angle of 60 deg. from the horizontal, as in Fig. 4, or a central nozzle pointing upward added, making a group of five. In the latter arrangement the other nozzles point inward at an angle of about 75 deg., as shown in Fig. 5. For the group arrangement higher operating efficiency is claimed as compared with an arrangement where the nozzles are spaced far apart, the theory being that as the water is discharged, on account of the close proximity of the nozzles, it collides and forms a finer spray. Spraying on a waterproofed roof is sometimes economical when water can flow to a well and then to a pump by gravity.

The forced-draft cooling tower is not unlike other forms of towers, except that its operation need not be entirely dependent on the weather. The filling and type of distributer may vary with different manufacturers, but the principle of entirely inclosing the cooling surface and using fans for the forcing of air through these surfaces is carried out in all such types. One or two fans may be used and the air supply may thus be readily controlled. In connection with the fans deflectors are usually installed to govern the course of the ascending air currents. On account of these features a fan or forced-draft cooling system requires a relatively small ground area, being approximately 0.2 sq. ft. for each gallon of water cooled per minute. The cooling surfaces in this form of tower are more commonly arranged in a vertical position and may be of wood, tile or wire-mesh mats over which the hot condensed water is allowed to trickle, exposing a large water surface to the action of the air forced upward by the fans. A forced-draft tower is shown in the diagram Fig. 6.

Sometimes this form of tower is so arranged that it may be operated as either a chimney type or a forced-draft cooling system. This is accomplished by adding a short stack or chimney which also acts as a spray catcher when the fans are operating and by providing removable panels or doors which may be opened for the admission of air. In this way the power required for the fans may be saved during cold weather and the air admitted around the base on the chimney principle.

The rotary form of water cooler has not been extensively used in this country, but its performance abroad places it among the systems described. Its operation is not entirely dependent on the atmosphere, and it may be placed in an engine room. As shown in the outline diagram Fig. 7, the machine is of the forced-draft type, simple in construction and compact in design, consisting mainly of several sheet-iron rotors mounted on a shaft which is fixed to the tank containing the water to be cooled, while the fan is attached to one side and is driven by a belted adjustable-speed motor, the cooling surfaces being operated by a counter-shaft driven by chain from the fan shaft. The rotors, each forming a separate cooling unit, are run at slow speed and, being immersed in the lower water tank, carry up thin films of water which adhere to the surfaces and are cooled by air forced through the upper part of the drums above the water line. An enormous cooling surface may be obtained in a relatively small space. The cooling effect is produced in the same manner as in a forced-draft tower, partly by the rise of temperature of the air and partly by the resultant evaporation.

Make-up Water for Cooling Systems

In all cooling systems some provision should be made for keeping the water to be circulated constant in quantity. Since cooling arrangements lose some of this water owing to evaporation and to drift and spray due to the wind, the original supply must be drawn upon for make-up water. Automatic control of make-up water may be arranged for by the use of a simple ball-cock and float. The make-up water required for loss due to drift is small, and with a well-designed system the total make-up water required is approximately equal to the amount theoretically chargeable to evaporation.

On this basis the make-up requirements may be predetermined by a simple computation, for in every pound of water converted into vapor there are approximately 1000 units of latent heat. From this fact the following formula is derived, in which W stands for the gallons of make-up water required per minute, g for the gallons of circulated water per minute, T for the temperature of the hot or incoming water, and t for the temperature of the cooled water returning to the condenser, both in degrees Fahrenheit:

$$W = g(T - t) \div 1000.$$

In the case of a steam-turbine plant discharging 600 gal. of condenser water at 110 deg. Fahr. and returning it at a cooled temperature of 85 deg. Fahr., there will

TABLE III—AVERAGE WEATHER CONDITIONS FOR MONTH OF JULY, BASED ON GOVERNMENT DATA

State	City	Temperature in Deg. Fahr.	Relative Humidity in Per Cent	Wet Bulb in Deg. Fahr.	Wind, Miles per Hour	Direction of Wind
Alabama	Montgomery	81.0	70.0	73.5	5.0	S. W.
	Mobile	80.5	79.0	75.5	6.0	S.
	Birmingham	79.8	73.0	73.3	5.0	S.W.
Arizona	Yuma	91.0	65.0	71.0	....	W. & S.
	Phœnix	90.5	32.0	68.5	....	E.
Arkansas	Little Rock	80.0	72.0	73.0	5.0	S.&S.W.
	Fort Smith	80.5	68.0	72.5	5.0	E.
California	San Francisco	57.3	82.0	54.3	14.0	W.
	Sacramento	72.4	51.0	60.6	9.7	S.
	Los Angeles	67.4	72.0	61.6	4.5	W.
	Red Bluff	82.1	30.0	62.0	5.7	S. E.
	San Diego	66.9	78.0	62.4	5.4	S. W.
Colorado	Denver	71.8	46.0	57.8	7.5	S.
	Colorado Springs	67.9	52.0	56.4	....	....
	Pueblo	72.6	43.0	58.0	7.0	....
Connecticut	New Haven	71.9	73.0	65.9	8.0	S.
District Columbia	Washi gton	76.8	50.0	69.3	5.3	S.
Florida	Jacksonville	80.9	75.0	75.0	8.0	S. W.
	Key West	83.7	73.0	76.7	8.0	E.
	Tampa	79.9	79.0	75.0	6.0	E.&N.E.
	Pensacola	81.3	78.0	75.8	8.0	S. W.
Georgia	Augusta	80.5	74.0	74.0	5.0	S. & S. E.
	Atlanta	77.6	67.0	69.6	8.6	N. W.
	Savannah	80.5	79.0	75.5	6.4	S. W.
Illinois	Cairo	78.6	74.0	72.4	6.2	S.
	Chicago	72.3	71.0	65.8	15.1	S. W.
	Springfield	76.1	67.0	68.0	6.6	S. W.
Indiana	Indianapolis	76.4	65.0	68.0	8.2	S. W.
Iowa	Davenport	75.4	65.0	67.2	7.4	S. W.
	Des Moines	75.0	66.0	67.0	7.1	S. W.
	Dubuque	74.7	66.0	66.7	5.5	N. W.
	Keokuk	77.0	67.0	69.0	6.9	S.
Kansas	Concordia	77.7	58.0	67.2	....	S.
	Dodge City	77.7	56.0	66.7	....	S. E.
	Wichita	78.3	64.0	69.5	....	S.
Kentucky	Lexington	76.0	64.0	68.0	8.0	S. W.
	Louisville	78.6	64.0	69.6	6.1	S. W.
Louisiana	New Orleans	81.3	76.0	75.3	6.5	S. W.
	Shreveport	82.1	72.0	75.0	5.0	S. & S. E.
Maine	Eastport	59.8	81.0	56.3	....	S.&S.W
	Portland	68.0	71.0	62.0	....	S.
Maryland	Baltimore	77.3	70.0	69.6	6.6	S. W.
Massachusetts	Boston	71.3	70.0	64.8	9.3	S. W.
	Nantucket	67.5	85.0	64.5	....	S. W.
Michigan	Alpena	65.8	78.0	60.3	8.0	S.E.&W.
	Detroit	72.1	69.0	65.1	9.0	S.W.
	Grand Haven	69.7	70.0	63.2	9.0	S.W.
	Escanaba	66.7	73.0	61.2	8.0	S.
	Marquette	64.9	70.0	59.0	9.0	N. W.
	Port Huron	69.0	72.0	63.0	9.0	N. E.
	Grand Rapids	72.6	68.0	65.4	9.0	S. W.
Mississippi	Vicksburg	80.4	75.0	74.4	6.0	S. W.
Minnesota	St. Paul	72.1	67.0	64.5	7.2	N.
	Duluth	66.0	71.0	60.0	11.0	N. E.
Missouri	Kansas City	76.9	67.0	68.9	7.5	S.
	St. Louis	79.1	66.0	70.6	8.2	S. W.
	Springfield	75.7	69.0	68.5	7.7	S.
Montana	Havre	68.5	50.0	57.0	....	S. W.
	Helena	66.9	45.0	53.4	....	W.
	Miles City	73.0	41.0	62.0	....	W. & N. W.
Nebraska	North Platte	73.9	61.0	64.9	9.0	S. E.
	Omaha	76.5	59.0	66.5	7.0	S.
	Valentine	73.1	57.0	62.5	10.0	S.
New Jersey	Atlantic City	72.5	84.0	69.0	8.0	S. W.
New York	Albany	71.0	71.0	65.5	7.7	S.
	Buffalo	70.2	71.0	64.0	10.9	S. W.
	New York	73.5	71.0	67.0	9.1	S.&S.W.
	Rochester	70.4	67.0	63.2	7.1	S. W.
North Carolina	Charlotte	77.8	69.0	70.3	5.0	S. W.
	Raleigh	77.8	73.0	71.3	....	S. W.
	Wilmington	78.7	79.0	73.7	....	S. W.
	Asheville	72.2	.....	....	4.7	S. E.
North Dakota	Bismarck	70.2	60.0	61.2	9.0	N. W.
	Williston	69.2	56.0	59.2	9.0	N. W.
New Mexico	Santa Fe	68.7	45.0	55.2	6.1	N. E.
Ohio	Cincinnati	77.7	63.0	68.7	6.6	S. W.
	Cleveland	72.5	70.0	65.8	11.7	S. E.
	Columbus	75.0	64.0	66.5	8.7	S. W.
	Toledo	73.0	86.0	70.0	8.0	S. E.
Oklahoma	Oklahoma City	79.0	64.0	70.0	9.0	S.
Oregon	Portland	65.2	39.0	52.0	7.9	N. W.
	Roseburg	66.1	58.0	57.0	4.0	N. W.
Pennsylvania	Erie	71.8	69.0	64.8	9.0	W.
	Philadelphia	75.8	66.0	67.8	9.4	S. W.
	Pittsburgh	74.6	68.0	67.1	5.2	S. W.
	Scranton	71.8	68.0	64.5	6.1	S. W.
	Harrisburg	74.5	67.0	67.0	5.7	W.
South Carolina	Charleston	81.3	76.0	75.3	9.8	S. W.
	Columbia	81.1	72.2	74.1	7.0	S. W.
	Aiken	81.3	65.5	72.5	....	....
South Dakota	Huron	71.6	65.0	63.6	10.4	S. E.
	Pierre	75.0	51.0	63.0	9.6	S. E.
	Rapid City	71.9	47.0	59.5	7.5	W.
	Yankton	74.6	66.0	66.8	6.5	S.
Tennessee	Chattanooga	77.8	71.0	70.8	5.2	S. W.
	Knoxville	76.2	74.0	70.2	5.0	S. W.
	Memphis	80.7	68.0	72.7	7.4	S. W.
	Nashville	79.4	68.0	71.4	5.0	S. W.
Texas	Abilene	82.2	52.0	69.2	9.0	S.
	Corpus Christi	81.9	80.0	76.9	12.0	S. E.
	El Paso	80.5	76.0	64.5	9.7	W. & E.
	Galveston	83.0	51.0	77.0	10.0	S.
	San Antonio	82.4	65.0	73.4	7.0	S. E.
	Fort Worth	82.5	51.0	69.5	10.0	S.
Vermont	Northfield	66.1	78.0	61.6	....	S.
	Burlington	68.2	76.0	63.2	....	S.
Virginia	Lynchburg	77.3	69.0	69.8	....	S. W.
	Norfolk	78.4	74.0	72.6	....	S. W.
Washington	Seattle	63.3	64.0	56.3	5.5	W.
	Spokane	68.8	81.0	55.0	....	S. W.
	Walla Walla	74.3	76.0	59.0	....	S.
West Virginia	Parkersburg	74.9	68.0	67.5	4.0	W.
Wisconsin	Green Bay	69.6	68.0	62.6	8.0	N. & S.
	La Crosse	72.6	71.0	66.0	6.0	S.
	Milwaukee	69.7	77.0	64.7	9.8	N.
Wyoming	Cheyenne	67.4	48.0	54.6	8.0	N.W.&S.
	Lander	66.6	42.0	52.6	4.0	S. W.

The data in the above table have been arranged by Mr. B. H. Coffey, mechanical engineer, the Cooling Tower Company, New York City, and represent the average of twenty-four-hour conditions for a period of thirty-two years as reported by Prof. Frank H. Bigelow in "Bulletin S" (1909), published by the United States Department of Agriculture. The wet-bulb temperatures given were obtained by combining the mean vapor pressure and the mean air temperature from "Bulletin S" for each of the different observation stations throughout the country. The relative humidity was taken from government psychrometric tables and corresponds to the vapor-pressure and wet-bulb depression (air temperature less wet-bulb temperature) for the altitude and average temperature of the observation station given. This value of relative humidity then is one that corresponds to an average twenty-four-hour temperature and not the average of morning and night readings of a wet bulb. Mr. Coffey has derived the accompanying empirical formulas, in which the figures of the table may be substituted to determine the final temperature of water to be expected when passed over a well-designed cooling tower and the thermal efficiency of the device:

$$T_1 = 0.25(t + 2t_1 + T) \text{ and}$$

$$E = 0.5 + (T - t) + 4(T - t_1),$$

where T is initial water temperature, T_1 final water temperature, t atmospheric temperature, t_1 wet-bulb temperature, and E the efficiency of the cooling tower.

be required the following quantity of make-up water, according to the above formula:

$$W = 600(110 - 85) \div 1000 = 15 \text{ gal. per minute.}$$

Then 15 gal. divided by 600 gal. equals a loss of 2½ per cent, or the amount of make-up water which must be purchased from an outside source while the cooling equipment is in operation.

Performance of Cooling Systems

Cooling systems in this country are usually designed for an average climatic condition of 75 deg. Fahr. and a relative humidity of 70 per cent, the cooling surfaces being so proportioned that the rate of heat dissipation is virtually governed by the temperature of the incoming

water. Such design must of necessity be based on empirical formulas derived only through experience, especially as the atmospheric conditions not only vary according to location but also fluctuate continuously throughout the day. It is also true that the temperature of the discharged condenser water will vary during the hours of operation so that by taking average figures for such variables no true relation is found to exist between them.

This may perhaps be illustrated best by actual operation in a modern plant situated where the average summer conditions are: Air temperature, 90 deg. Fahr.; relative humidity, 60 per cent. The curves of Fig. 8 give the results of some observations at ten-minute intervals at this plant during March, 1914, when there was a southwest wind blowing at 15 miles per hour. It may be of interest to note the temperature of the outgoing cooled water as compared with wet-bulb temperature, which is the limit to which the water could be cooled if the equipment worked at 100 per cent efficiency. In this case the effect was secured by an atmospheric cooling tower. The average of the day's run gives a mean temperature of 75 deg. Fahr. and a relative humidity of 34 per cent, while the average temperature of the cooled water is 74.5 deg. Fahr. Taking these as average atmospheric conditions, it is clear that with a perfect thermal efficiency the cooling system could not reduce the temperature to more than 58 deg. Fahr.

From this it is apparent that the work of a cooling system really depends on the temperature of the air and the relative humidity, as the varying heat of the incoming water must be distributed through the apparatus, and this must be cared for in the design. An approximation of the results that may be expected from any re-cooling plant may be determined by the use of the chart shown in Fig. 9. Knowing the local temperature and humidity, the lowest temperature to which the water may be cooled is found on the left-hand scale. However, in actual practice this temperature can be approached only within 5 deg. above, with average operating conditions. As an example showing the use of this chart, an actual instance will be taken from an installation where a natural-draft tower handles 3000 gal. of water per minute at a temperature of 98 deg. Fahr. The air temperature is given as 82 deg. Fahr., with a relative humidity of 65 per cent and the water cooled down to 74 deg. Fahr. These figures were obtained at 2 o'clock in the afternoon during a day last month, and simply show what the system was then doing. Average performance would probably not show such good results. Referring to the diagram, follow up from the bottom scale at 82 deg. Fahr. until the vertical intersects with the curve of 65 per cent relative humidity, and then read along the diagonal to the scale at the left, showing that the lowest temperature to which the water could be reduced is 73 deg. Fahr.

From the foregoing considerations it is seen that when the performance of a cooling system is determined by the use of this chart (Fig. 9) it should be borne in mind that the cooling system is considered as properly designed for the conditions. In other words, when selecting a cooling equipment the decision should take into consideration the maximum conditions of incoming water temperature and the atmosphere, for if only average conditions are taken into account the results will not always be satisfactory because of the variables that are included. It is important to realize thoroughly that dealing with the elements means the handling of uncertain values.

Considerations in Selecting Cooling Systems

The question that naturally arises in considering the use of some form of cooling system in conjunction with

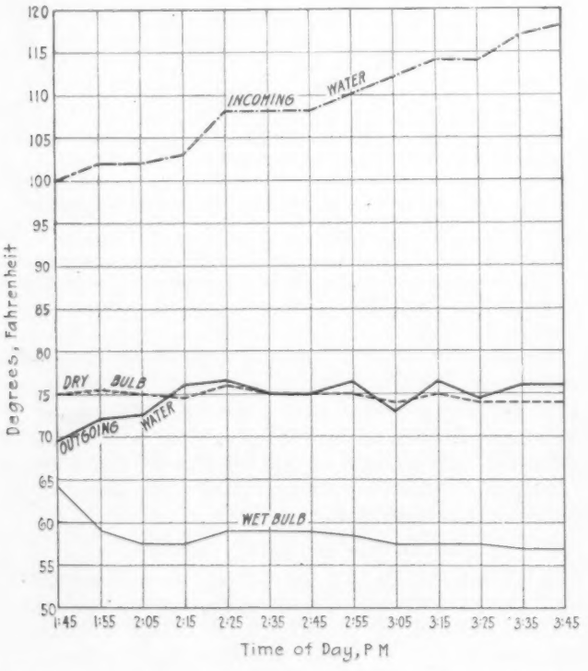

INCOMING WATER
DRY BULB
OUTGOING WATER
WET BULB
Degrees, Fahrenheit
Time of Day, P M
1:45 1:55 2:05 2:15 2:25 2:35 2:45 2:55 3:05 3:15 3:25 3:35 3:45

FIG. 8—OPERATING DATA FOR A COOLING TOWER, SHOWING TEN-MINUTE VARIATIONS

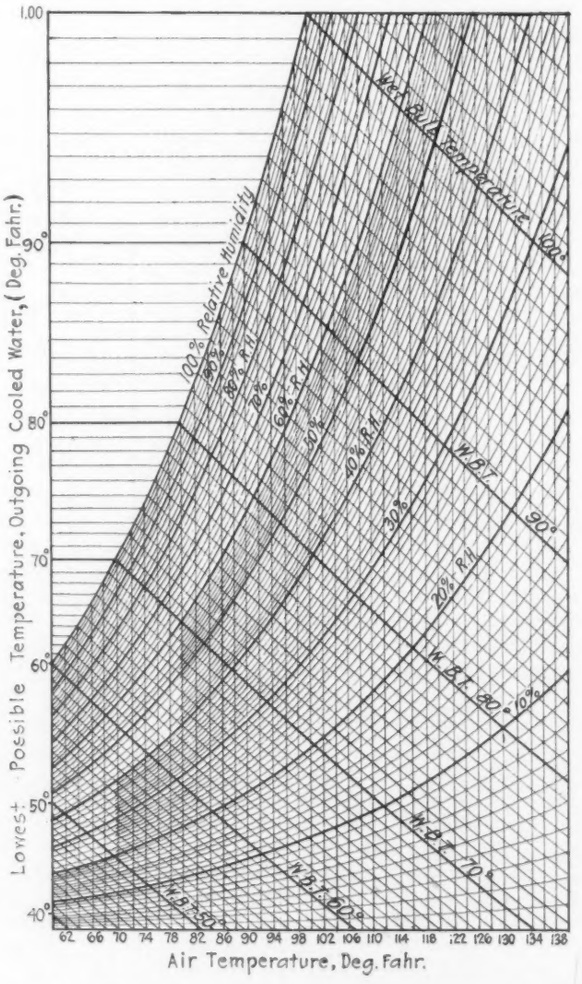


FIG. 9—PSYCHROMETRIC CHART ADAPTED TO GIVE LOWEST POSSIBLE TEMPERATURE FOR COOLED WATER

a condensing station is whether or not the results secured by a cooling system are more economical than purchasing water or sinking a well for the purposes of water supply. In general, when the interest upon the cost of a cooling system plus the expense of maintenance and operation is less than the annual cost of water from the city or well supply for condensing purposes, then the use of such cooling apparatus or system is certainly justified.

Having decided on the use of some form of cooling device, it then becomes a problem which specific type to employ. This may readily be decided on by considering the various items that enter into any feature of operating expenditure, as follows: With C denoting the total annual charge against the system, then

$$C = F + P + M.$$

In this equation F equals the annual fixed charges on the total capital outlay, not simply on the cost of apparatus but including such items as interest, depreciation, insurance and taxes; P represents the cost of power chargeable to pumping and the operation of the fans if used in connection with the cooling system, and M denotes maintenance, which covers the cost of attendance, supplies and repairs. By comparing the values of C for the various cooling systems under consideration that will satisfy the operating conditions, the one which has the smallest annual operating expense is the type of cooling plant to employ. The above consideration is based on the assumption that most commercial forms of cooling apparatus may be relied on for similar results. In practice, however, this may be slightly modified not only by the apparatus but by the physical location of the power station and area of land available for the cooling system.

Motors Simplify Operations in Milk Depot

Five Men Receive, Pasteurize and Bottle 6000 Lb. of Milk per Hour by Means of Electrically Operated Equipment

BY J. L. WILTSE

AN interesting example of improved methods in handling milk due to the use of electrically operated apparatus and conditions that tend toward economy and sanitation is found in the plant of Mr. Henry A. Rusch, Brooklyn, N. Y. This plant as equipped and operated at the present time is capable of handling 6000 lb. of milk per hour, with the building and layout of apparatus arranged for an ultimate capacity of 12,000 lb. per hour. Milk is shipped to this plant in cans from farms in Pennsylvania, and when taken from the cars is placed in a cold-storage room served by the motor-operated refrigerating plant shown in the accompanying illustration. The milk is taken from this cold-storage room as needed and emptied into a receiving vat, where it is strained and tempered, and then lifted by a 1-hp. motor to the top floor of the pasteurizing department. The empty milk cans are then placed upside down on a rack, where they are automatically washed, cleaned and dried, and placed in a cool room ready to be shipped back to the farm.

The pasteurizing department is in a separate and isolated portion of the building and is finished with glazed-tile walls, enameled ceilings and waterproofed floors. Every five minutes this department is supplied with 6000 cu. ft. of purified air, tempered to suit the various atmospheric conditions. Under these conditions it is impossible for the air to become stagnant and practically impossible for insects to thrive or exist. On the top floor of the pasteurizing section the milk is emptied into a 500-gal. storage vat, where it is mixed by fan-shaped blades operated by a 1-hp. motor to prevent the cream from rising, the temperature being kept at about 60 deg. Fahr. during the mixing process. The milk from this storage vat passes through a clarifier, operated by a small motor, which removes any impurities, and then by gravity through pipes to the floor below, where it is heated to 142 deg. Fahr. Here curve-drawing thermometers which show the temperature of the milk at any time are installed.

The heating or pasteurizing of the milk is accomplished by means of hot water. The pipe containing the milk is inclosed within a larger pipe and the hot water forced through the space between the two pipes by a 1-hp. motor. The milk then passes into a holder consisting of a long series of pipes which are kept at an even temperature by steam. About half an hour is

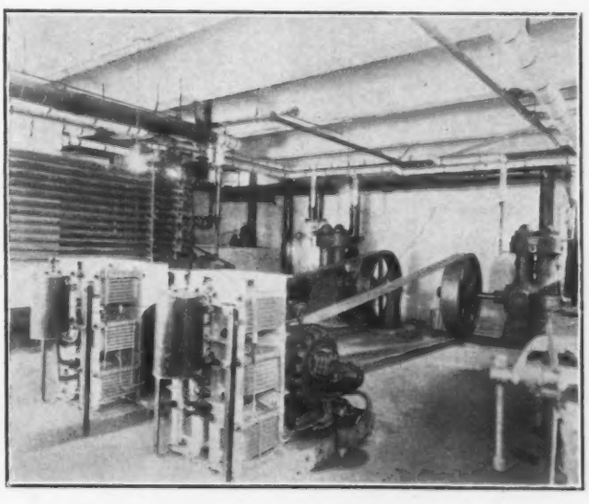


FIG. 1—MOTOR-DRIVEN 15-TON AMMONIA COMPRESSORS IN REFRIGERATING PLANT

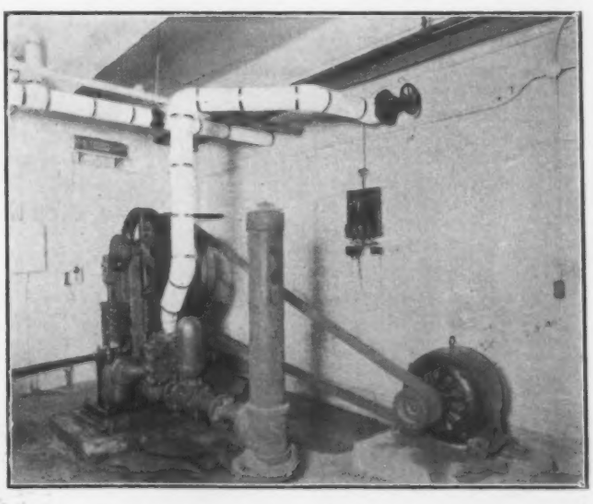


FIG. 2—MOTOR-DRIVEN WELL PUMP THAT FURNISHES WATER TO PLANT

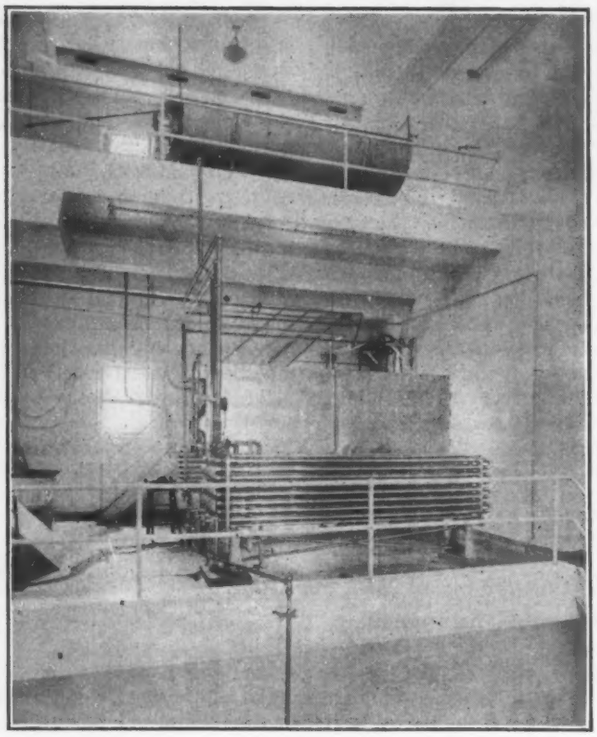


FIG. 3—SECTION OF PASTEURIZING DEPARTMENT

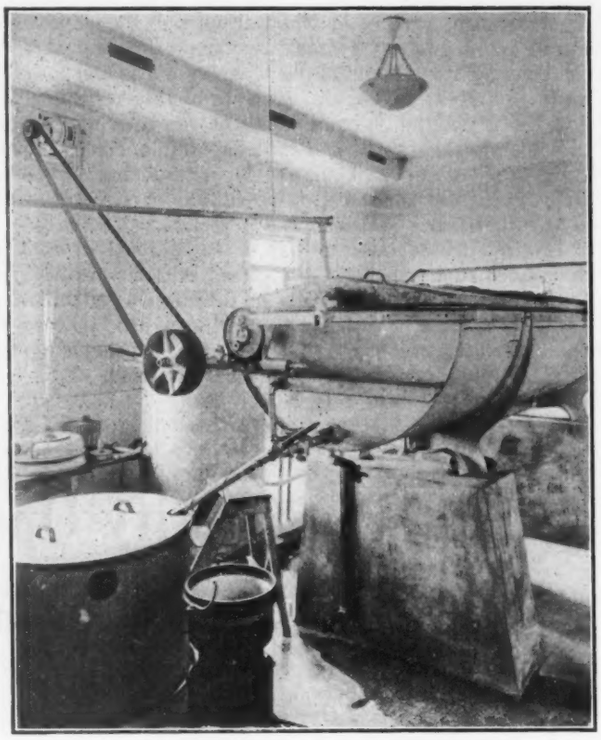
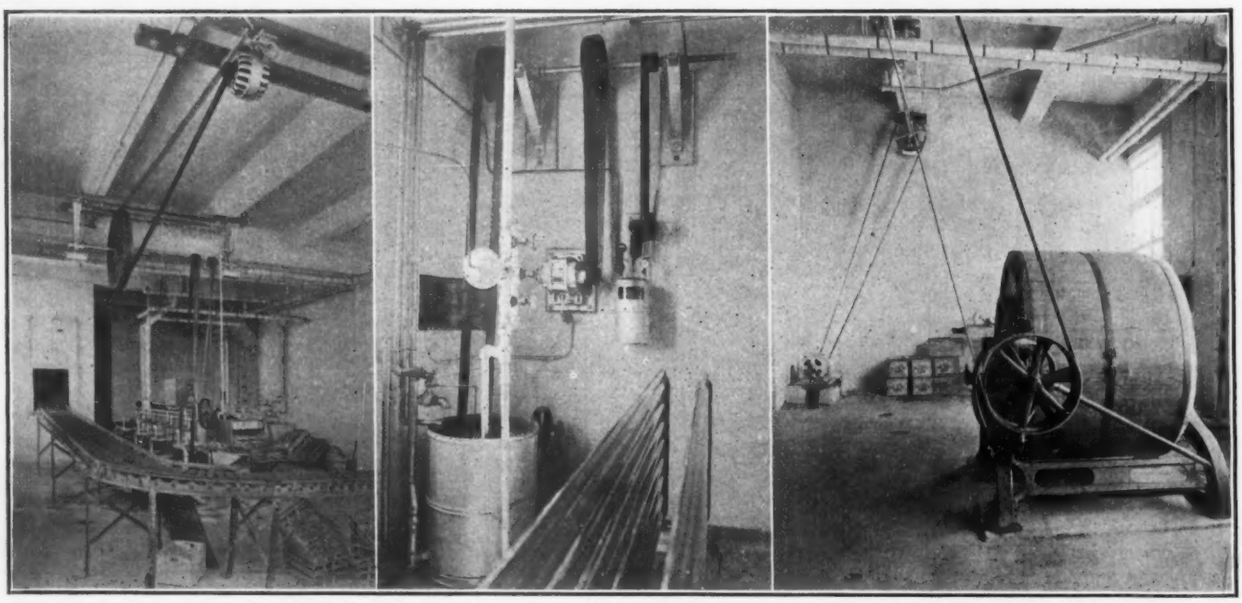


FIG. 4—MOTOR-DRIVEN DASHER AND SEPARATOR

required for the milk to pass through this holder, and as it emerges therefrom it flows through another series of pipes which cool it to a temperature of 40 deg. Fahr., the lowest temperature to which milk can be cooled without being likely to freeze. This cooling of the milk is accomplished by the circulation of well water and brine from the refrigerating plant through a system of piping encircling and inclosing the milk pipes in the same manner as the hot-water heating pipes previously mentioned. The milk is then carried through pipes to a small tank on the floor below and is ready to be bottled. Cases containing twelve bottles each slide under this tank and receive twelve pipes which fit over the top of the bottles and fill them. When a case is filled it is moved about 2 ft., where a capping machine automatically places a cap on each bottle. The cases of filled bottles are then placed on a gravity conveyor and lowered to a cold-storage room on the first floor. Here the milk is stored until the next morning, when it is sent to customers.

Handling and Cleaning Empty Bottles

The steel cases of empty bottles returned from customers are received on the platform of the first floor and transported to the third floor by means of an automatic feeding and discharging electric elevator operated by a 7.5-hp. motor. Gravity conveyors then carry them to the washing machines. Here a man places a cover over each case so that the bottles will stay in place when the case is turned upside down and placed in the motor-



FIGS. 5, 6 AND 7—BOTTLE WASHERS, STERILIZERS, CONVEYOR, AUTOMATIC PUMP AND MOTOR-DRIVEN CHURN

operated conveyor which carries the case through the washing machine. The washing machine is equipped with two 7.5-hp. motors driving centrifugal pumps, one of which is for hot water and the other for cold water. The cleaning water is forced by these motor-driven pumps up into the inverted bottles. Cold water is first used for the purpose of loosening any hard coating of milk. Hot water containing an alkaline is then forced into the bottles, after which clear hot water is used. As the bottles leave the machine they are examined for the purpose of determining if they are thoroughly clean. In examining the bottle the containing case is placed over a glass-covered box equipped with electric lamps in such a way that the light causes any particle of dirt to become visible. The bottle cases are then turned right side up and sent down a motor-operated conveyor to the cold-storage room below, where they are kept until needed. A gravity conveyor takes them to the adjoining room to be filled.

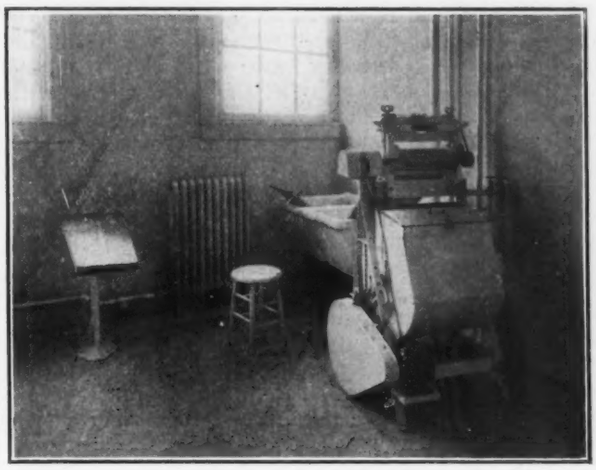


FIG. 8—ELECTRICALLY OPERATED LAUNDRY MACHINE

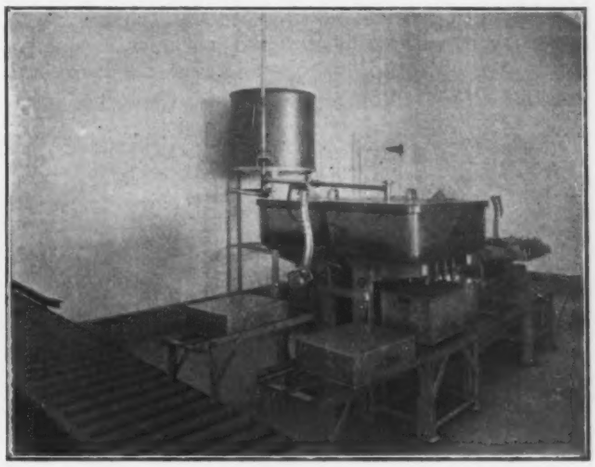


FIG. 9—BOTTLE-FILLING AND CAPPING MACHINE

MOTOR-DRIVEN EQUIPMENT IN A MILK DEPOT
All motors are two-phase, sixty-cycle, 220 volts.

No.	Motor, Hp.	Connection	Machine Operated
1	1.0	Direct	Pump for pumping milk from first to top floor.
1	1.0	Belted	Mixer used to prevent cream from rising in storage tank.
1	0.75	Belted	Clarifier to remove impurities.
1	1.0	Belted	Hot-water pump for pasteurizing process.
1	7.5	Direct	Elevator feeding and discharging bottle cases.
1	1.0	Belted	Conveyor through washing machine.
2	7.5	Direct	Centrifugal pumps on washing machine.
1	1.0	Belted	Gravity conveyor for lowering bottle cases to floor below.
2	25.0	Belted	York refrigerating machines, 15-ton compressors.
1	15.0	Belted	Triplex pump on artesian well.
1	1.0	Belted	Agitator.
1	50.0	Direct	Brine pumps.
1	5.0	Belted	Butter-churning machine.
1	0.5	Belted	Dasher.
1	0.75	Belted	Separator.
1	2.0	Belted	Rumsey pump.
1	3.0	Belted	Ice crusher.

The basement contains a horizontal tubular boiler which furnishes enough steam at 25 lb. pressure to do all the pasteurizing, heating and cleaning. A 25-hp. motor is employed for the ice and refrigerating plant, the water tank of which receives its supply automatically by a 15-hp. motor-driven triplex pump from an artesian well. This plant is capable of supplying 5 tons of ice per day and of maintaining the desired temperature in all the cold-storage rooms and store boxes of the establishment.

The forward portion of the ground floor is devoted to offices and a store fitted up in the most modern, sanitary and practical manner. The rear is portioned off into rooms for the purpose of shipping, cold storage, cream filling, milk storage, can washing, receiving, etc. The stable is situated in the rear of the plant and some distance from it. It is exceptionally sanitary, and during the summer months electric fans are used to agitate the air for the benefit of the horses and to eliminate the flies and other insects commonly found in such places as much as possible. The plant operates a motor equipment rated at about 100 hp. and about seventy-five lamps.

The lighting effect of the different departments is very pleasing owing to the light walls and arrangements of fixtures. In the pasteurizing department, as shown in Figs. 3 and 4, semi-indirect lighting fixtures are installed. The galleries of the building afford customers and interested visitors an opportunity to witness the sanitary processes while the plant is in actual operation.

One engineer is employed to take care of all machinery, and only five men are required to handle the operations involved in the pasteurizing process. The methods employed require labor only for the guidance of machinery and for cleaning purposes. During the winter season the cost of operating the plant is approximately $200 per month, while during the summer season, when the output is at a maximum, the operating cost is approximately $400 a month. In order to facilitate the work of employees, an intercommunicating telephone system is installed connecting the twelve departments of the plant. The original cost of all machinery installed was $27,000.

Mr. T. Engelhardt, architect, of Brooklyn, N. Y., designed the installation of equipment in this plant. The motors are operated from the lines of the Edison Electric Illuminating Company of Brooklyn.

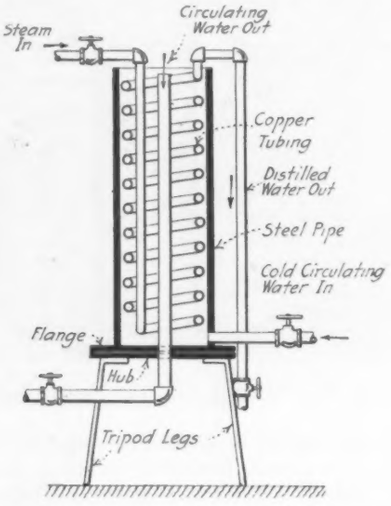
Preventing Valves from Sticking

Some valves in power-plant piping are used infrequently, but for that reason should not be neglected, as they may be required in an emergency when no time can be lost by assisting their operation with a monkey wrench. In order that valves may operate easily it is advisable to see that threads and valve steams are well smeared with a mixture of oil and flake graphite. This mixture may also be applied to packing rings as well as the stem, gland and threads when repacking valve stems.

Operating Kinks

Home-Made Still Saves Money

Formerly the Union Electric Company of Dubuque, Ia., bought distilled water to replenish the electrolyte in its vehicle storage batteries. This method of obtaining pure water proved expensive, and a home-made still was devised to provide the supply. An old piece of 12-in. iron pipe flanged, headed and set upright upon a tripod, as shown in the accompanying diagram, was



SECTION THROUGH A HOME-MADE STILL

used to form a container or main cooling receptacle for a 35-ft. coil of copper tubing. A cooling-water entrance was provided at the base of the container and an overflow arranged near the top, as shown. The coil of copper tubing, 10 in. by 35 in., inside of the iron pipe was connected at one end to a station steam header carrying 175 lb. per sq. in. pressure.

When it is desired to make distilled water the cooling-water system is opened to permit circulation. Steam is then admitted to the coil of copper tubing. By adjusting the valves in both the steam and the cooling-water lines, the flow of pure water from the end of the copper coil can be regulated. The still was designed by Mr. G. W. Schmidt, chief engineer at the power house of the Union Electric Company, and now supplies not only the electric company's needs, but an additional amount which is sold to others.

A Safety-First Competition Among Employees

The Pensacola (Fla.) Electric Company is encouraging its street-railway employees in the prevention of accidents due to carelessness by conducting a "safety-first" competition. The motormen and conductors are grouped into two teams, each in charge of a captain, who chooses men of varying terms of service with the company. These two teams compete for a period of two months in the prevention of accidents. At the end of this trial period the winning team is banqueted by the company at a prominent hotel, when the officials of the company have an opportunity of coming into closer contact with the men who compete.

In order to determine which team has the better standing at the end of the two months all accidents are rated in points. The more serious accidents and those where carelessness is the controlling factor are rated highest, at from 50 to 100 points. For the accidents where others than employees are to blame but few points are counted against the team. All accidents are, however penalized and rated at a certain value, depending on the possibility of preventing the accidents. To discourage a crew from failing to report an accident in order to save a penalty, the highest penalty of all is attached to a suppressed report.

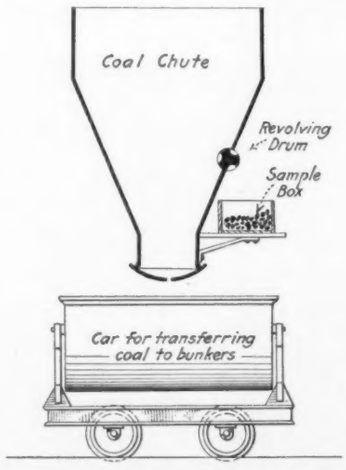
A "safety committee," composed of the railway superintendent, claim agent, one inspector and the two team captains, passes on all accidents. This committee meets every Monday morning and reviews the accidents of the previous week, attaches rated penalties to each and then posts bulletins that show the team scores, with suggestions for accident prevention. In case of a disputed point the opinion of the majority of the "safety committee" is final.

In regard to this activity, Mr. T. J. Hanlon, Jr., manager of the company, writes: "The effect of this competition has been to place the men in a spirit of rivalry, and we are convinced that careless accidents have been greatly reduced. The men have the principles of 'safety first' instilled in their minds to the point where it is their first thought."

While the above plan is being used in connection with street-railway operation, it is decidedly adaptable to all lines of work where thoughtfulness in the performance of duties will eliminate hazards to property and life.

A Method of Obtaining Representative Coal Samples

The collecting of samples of coal for analysis in shovelfuls when the coal is being received is at best a tedious and sometimes difficult task, aside from being unsatisfactory from the standpoint of making a fair analysis possible. A very simple and much more satisfactory method is shown in the accompanying illustration as employed at the 201st Street station of the United Electric Light & Power Company, New York City. In one side of the chute through which all coal is delivered to the station a small motor-driven drum is installed having equally spaced pockets in its face. As the drum revolves a small amount of coal is collected in these pockets and transferred to sample box beneath. This



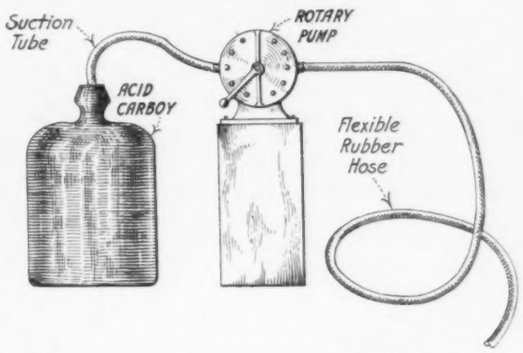
AN AUTOMATIC COAL-SAMPLING ARRANGEMENT

box holds about 100 lb. As it fills up this amount is taken to a chemical laboratory, where it is crushed, mixed, quartered, mixed again, quartered and passed through a sixty-mesh sieve. A proximate analysis, or one which determines the percentage of fixed carbon, volatile matter, moisture and ash, and an ultimate analysis, or one which reduces the fuel to its elementary

constituents of carbon, hydrogen, nitrogen, sulphur, moisture and ash, are made with the pulverized coal sample and payments made on the results of these tests.

Method of Transferring Acid Without Waste

By employing equipment similar to that shown in the accompanying drawing the New England Telephone & Telegraph Company at Boston has been enabled to fill its battery tanks with electrolyte direct from the carboys without waste or loss of time. The apparatus consists of a bronze centrifugal pump and flexible tubes

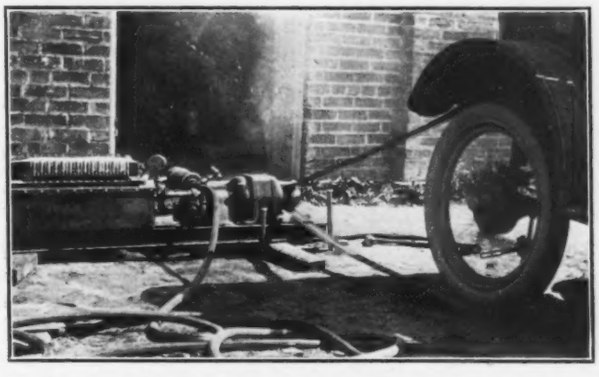


APPARATUS FOR FILLING BATTERY JARS

connected with its inlet and outlet. The suction hose, which is rather short, is inserted in the neck of an acid container, while a much longer hose is used to convey the acid to the battery jars, making it necessary to move the pump only occasionally. In one case, by this means, acid was conveyed from the rear yard of an exchange to the second floor of the building, a distance of 17 ft. By forcing a solution of ammonia and water through the pump each time after it has been used it is possible to minimize corrosion and thereby obtain satisfactory operation.

An Emergency Drive

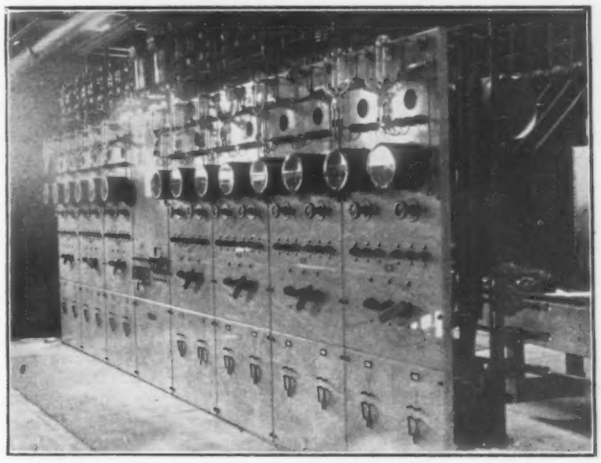
The accompanying illustration shows how a Ford automobile was used to drive an oil filter press when three 200-kva. transformers at the Toppenish (Wash.) substation of the Pacific Power & Light Company were replaced by as many 333-kva. units. This method of drive was selected as no suitable power was available for operating the filter-press motor when the new transformers were being substituted for the old. The oil could not be filtered before the units were in place as the same oil that formerly filled the old transformers was used. As shown in the illustration, one of the rear wheels of the automobile was jacked up a few inches above the ground and a 3-in. belt used to connect the driving wheel with the motor pulley of the filter press. The filter press, pump and motor were rigidly attached to a steel base, which was prevented from moving by iron pins driven in the ground.



FILTER-PRESS PUMP BELTED TO WHEEL OF AUTOMOBILE

An Arc-Rectifier "Kink" That Failed

Seeking a way of increasing the life of mercury-arc converters operating on the local arc-lamp circuits, the engineers of a central station in the Middle West decided to try cooling the tubes by means of air blasts.



ARRANGEMENT IN AN ATTEMPT TO COOL ARC-RECTIFIER TUBES BY AIR

Accordingly a system of sheet-iron piping was installed on the rear of the switchboard, and vent holes cut in the marble panels were connected by smaller pipes to a main air header. A motor-driven blower was installed to furnish the blast. Shortly afterward, however, it was discovered that the air blasts striking the tubes at their mid-points set up unequal strains in the heated glass and soon destroyed the tubes. Finally convinced of the failure of this "kink," the company purchased and installed oil-cooled rectifiers and plugged the holes in the switchboard.

The Return of Heating-System Condensation to Boilers

In central heating plants there is usually a period during the morning of cold days, or occasionally at other times, when the demands for heat require the withdrawal of large volumes of steam from boilers into the heating mains and then to the heating system. While the first water of condensation from steam turned into a cold heating system will be returned at a rate far in excess of the later returns when the system is thoroughly heated, an hour or even more may elapse before steam returns in the form of condensate. When so returned it is pumped back into the boilers, thereby restoring the normal water line. The result is a variable water level. This is not a serious condition when properly handled; in fact, a direct saving is possible through the return of the hot condensate to the boilers in such a way as to make the best use of the heat it contains. If a direct water-level control is applied to the boilers when steam is first withdrawn, additional water would be supplied only to be wasted upon the return of condensation from the heating system because the boilers would be full. Such a waste does not involve the water alone, but also the heat contained in the water of condensation, a more serious factor.

Questions and Answers

Nature of Metallic Alloys

Is an alloy of metals a compound or a mixture? S. G. F.

As a general rule, metallic alloys are not chemical compounds; that is, their compositions are not expressible by definite chemical formulas. They are usually mixtures of metals, although the mixtures are very uniform and complete. It is only very rarely that an alloy forms a true chemical compound.

Lifting and Non-Lifting Injectors

Will you please explain the difference between the lifting injector and the non-lifting injector? P. W.

A lifting injector is one that, in addition to forcing water into the boiler, exerts a suction effect so that it can lift its own supply of water from a source considerably below its own level. A non-lifting injector is unable to lift its water supply and can only force it into the boiler; hence water must flow to it from some higher point.

Effect of Treatment on Tensile Strength of Wood

Do any of the treatments for prolonging the life of timber decrease its strength in any way? H. W. S.

So far as known, the materials used in treating timber for preservation do not decrease the strength of the wood. The injury that often results to the strength of treated timber is mainly due to overheating in the seasoning of the timber and in the application of the preservative. The cells and fibers of wood may be ruptured when using the vacuum and pressure process of impregnating wood. The effect of treating wood upon its strength seems to be more a question of the proper method of preservation than it is of the character of the preservative used.

Cleaning Soot from Boiler Tubes

How often should the tubes of a boiler be blown out to keep them free of soot? H. W. Y.

The frequency with which the blower should be used depends on the type of boiler, the soot-producing qualities of the fuel, the efficiency of firing, and on whether a hand blower or a mechanical blower is used. If the blower is of the mechanical kind that is fixed permanently in place and that blows all the tubes at one time, the labor required to operate it is reduced, and blowing may be done two or three times in a day of twenty-four hours. But if the hand-operated, single-jet blower is used, the labor involved reduces the number of cleanings to one a day. It seems to be generally conceded that the tubes should be blown at least once a day. But if much soot is formed it will be found economical to blow them out oftener, even at the expense of additional labor.

Effect of Throttling Governor on Steam Economy

If a steam engine using saturated steam is controlled by a throttling governor, what is the effect on the steam consumption per horse-power-hour when the governor throttles the steam, as compared with a governor that changes the point of cut-off? U. S. F.

So far as the results of tests show, there is no alteration in the steam consumption. It must be remembered that one of the greatest causes of loss in the steam engine is cylinder condensation, and this may be reduced largely by using superheated steam. The throttling by the governor wire-draws the steam and reduces its pressure, thus making the pressure less effective; but the wire-drawing at the same time dries or superheats the steam at the lowered pressure. The dry or superheated steam thus introduced into the cylinder reduces the loss due to initial condensation. So, although there is a loss caused by reduced pressure, there is a compensating gain due to the smaller amount of condensation, and the engine governed by throttling is just as economical as the one governed by changing the cut-off.

Measuring the Steam Consumption of an Engine

What is the approved method of determining the amount of steam used by an engine during a test? E. F. H.

If a surface condenser is available, the exhaust steam from the engine being tested may be condensed, and the condensate then measured or weighed. In this way the actual amount of steam passing through the engine is definitely and accurately determined. It is assumed, of course, that there are no leaks in the exhaust piping or in the condenser. Another way of attaining the same object is to supply the engine with steam from a single boiler or battery of boilers that has been completely isolated from any other boilers in the plant. The conditions of water level, firing and pressure are kept constant during the test, and the amount of feed water supplied is carefully weighed. As the engine takes all the steam generated, the amount of feed water supplied is also the amount of steam used. This method is more likely to introduce error, however, because it is exceedingly difficult to keep the working conditions uniform. For this reason a test made in this way should extend over a period of several hours, so that the effect of any slight error will be minimized. If the condenser method is used, the time of the test may be reduced to an hour; but it should not be begun until the engine has been running for a time and has reached normal working condition.

Apparatus for Taking Flue-Gas Samples

Can you suggest a reliable arrangement for taking long-period samples of flue gas? S. H. B.

Flue-gas samples can be taken continuously over a long period by filling a receiver with water and drawing it off gradually through a siphon. A 3-gal. glass bottle equipped with a rubber stopper through which two glass tubes can be run is a very convenient form of receiver. One tube should connect the space over the water with the flues; the other, which serves as a siphon, should extend to the bottom of the bottle and discharge into a similar bottle placed at a lower level than the gas receiver. A brass rod containing a small axial hole or a constricted glass tube should be connected in series with the siphon discharge tube to prevent too rapid emptying of the bottle. The distance between the discharge end of the siphon and the bottom of the bottle may also be adjusted to regulate the rate of flow, but it should be remembered that the latter will vary over a greater range if the bottom of the upper bottle and the discharge end of the siphon are too near the same level. For instance, if the difference in level between the discharge end of the tube and the bottom of the gas receiver is fifteen times the initial depth of the water in the gas receiver, the rate of flow will change about 3 per cent, whereas if it is only three times the initial depth of the water it will change about 14 per cent. One way of making this change as small as possible is to lay the bottle on its side in a cradle so that the depth of the water will be a smaller proportion of the total head. Another way is to support the discharge end of the tube so that it will lower at the same rate as the water level in the upper bottle. The latter may be done by suspending the lower bottle from a spring which will deflect a distance equal to the depth of the water in the gas receiver when all of the water is in the lower bottle.

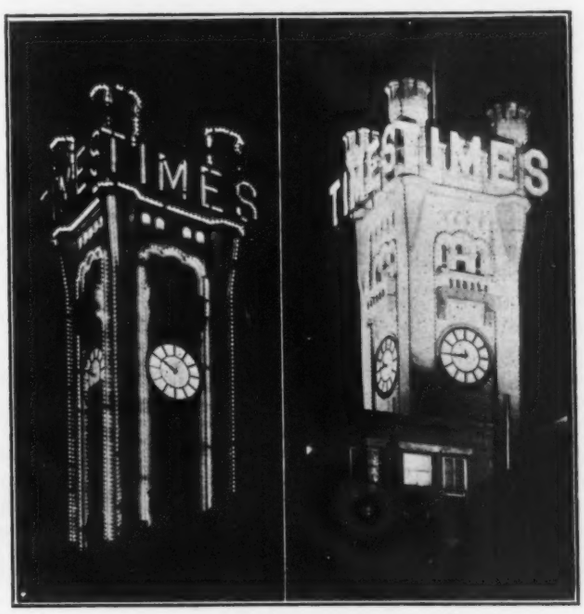
COMMERCIAL SECTION

Flood Lighting Versus Outline Lighting

The tower of the Times Building at Los Angeles, Cal., was until recently lighted in outline by 900 30-watt carbon lamps, making a total load of 27 kw. Replacing this outline illumination, flood lighting is now used, the light being supplied by two sets of four 20-in. nickel parabolic reflectors (each containing a 500-watt gas-filled stereopticon tungsten lamp), and by two sets of two similar reflectors and lamps, the entire flood-lighting installation representing a total load of 6 kw. The accompanying illustration shows the relative effectiveness of the two installations.

Taking the average cost of outlining at $1 per lineal foot, the cost of outlining the tower amounted to at least five times the cost of installing the flood-lighting system. The wiring for the outlining was installed in conduit fixed to the face of the tower, and condulet receptacles had to be provided every 6 in. The outlets had, of course, to be arranged about the outline of the principal architectural features, such as the battlements, windows, balconies, etc., and while the wiring was made as inconspicuous as possible, the difficult working conditions for outlining the tower undoubtedly marred, to a certain extent, the appearance of the building. The task of replacing burned-out lamps was also especially difficult and hazardous on this tower.

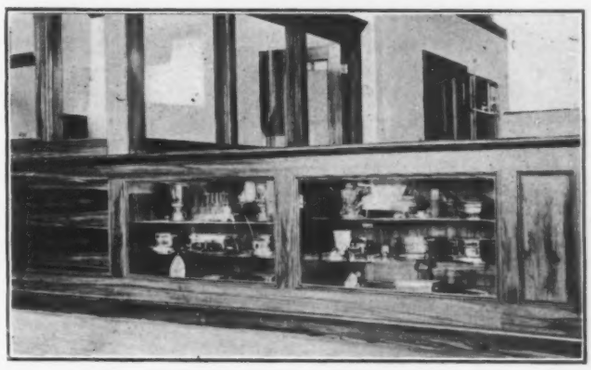
The sets of lamps for flood lighting are arranged in sheet-metal housings with glass doors, thus protecting the lamps without interfering with the beams of light. The principal batteries, of four projectors each, are placed 150 ft. from the tower on neighboring buildings. The small batteries are mounted on the roof of the Times Building itself, beneath the tower, and serve to intensify the illumination on the south and east walls. In addition to the fact that more efficient, more intense and less costly illumination has resulted from the use of the flood lighting, it is found that the labor item of maintenance is now quite inconsiderable. Energy is supplied by the Southern California Edison Company.



FORMER OUTLINE ILLUMINATION AND PRESENT FLOOD LIGHTING OF THE TIMES TOWER, LOS ANGELES

Doing Business Over Appliance Sales Counter

At the new sales office of the Salem (Mass.) Electric Lighting Company, an attractive display of appliances is housed in two recesses in a counter, as shown in the accompanying halftone. The counter is of gumwood and the various devices are exhibited on plate-glass shelves adjustable in height, in compartments about 3.5 ft. long, 3.5 ft. deep and 21 in. high. Access to the equipment is by hinged doors at the rear. The display fronts the main entrance of the office and is placed just at the right of the cashier's grill, so that it is seen by all visitors to the premises. The various devices are well set off by the finish of the counter, the nickel plating harmonizing to an exceptional degree with the tones of the wood.



APPLIANCE COUNTER USED FOR TRANSACTING BUSINESS

Gas and Electricity Accounts on One Bill

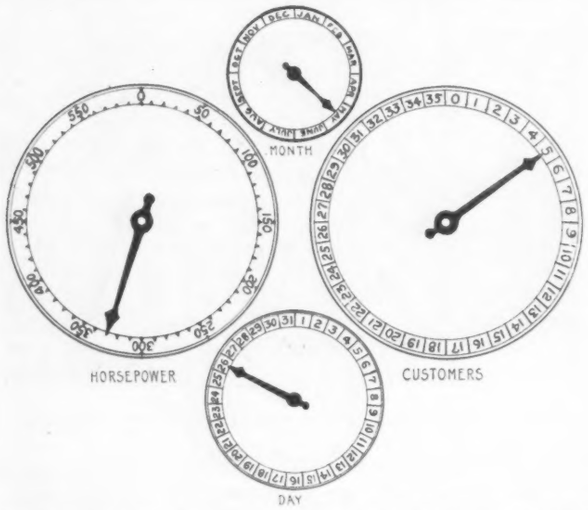
When the Rochester (N. Y.) Railway & Light Company has effected all of the changes incidental to introducing a continuous-billing system, including the reading of meters successively during the month in each of the twenty-two districts into which the city has been divided, its bookkeeping system will have been almost entirely revised.

Under the new system the gas and electric meter "reads" in each district are permanently routed, and after having been filled in by the meter reader, the meter route books are transmitted to the billing clerks, whose duty it is to prepare the bills on a combination gas, electricity and appliance form. The billing clerks forward the bills to the debit posters for entry in the combination customers' ledger. Besides combining, as will be done in the near future, the gas, electricity and appliance accounts in one ledger, the combination bill will enable the company to work out statistical classifications on the Hollerith tabulating machine in one operation. Before long the company expects also to eliminate all meter readings from the ledgers and to depend on the meter route books for this information.

Motor-Service Data at a Glance

Although the man in charge of the motor-service sales department of a central station can, of course, ascertain from his ordinary office records the number of motor-service customers connected and the total motor load served by his company's lines, it is nevertheless often extremely convenient to have a graphic record of motor installations which can be read at a glance by his salesmen and even by laymen.

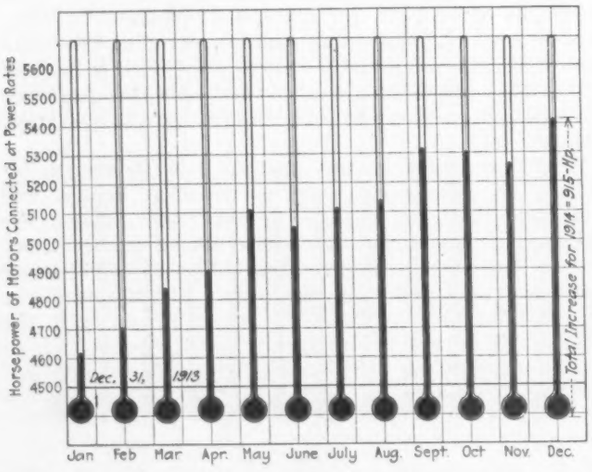
The accompanying sketches show the schemes used by the power engineer of the Fall River (Mass.) Electric Light Company, Mr. F. S. Root, and are self-explanatory. These sheets are hung on the wall in the room used by the motor-service salesmen, the dials on the first sheet being advanced each day in accordance with the figures shown by the report of connected load for the preceding day. The data on the other sheets are added at the close of each month. The clock hands for



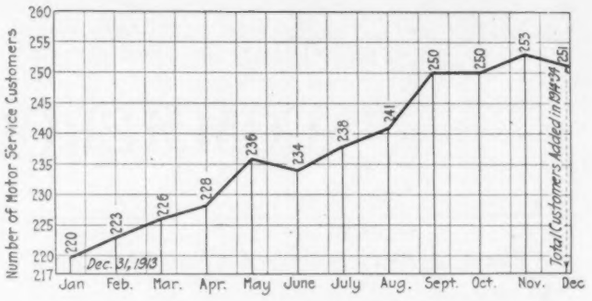
THESE DIALS SHOW NEW BUSINESS ADDED DURING MONTH

the dials were cut from heavy cardboard and are pivoted on a thumb tack. The hand may be further steadied by another tack placed near the point, if desired.

Very little time is required to keep these graphic records up to date, and the results can be read at a glance. The total load can, of course, be ascertained for any day by adding the results shown by the dials to the totals for the preceding month, which appear on data sheets. Two more dials, one for total horsepower and one for total number of customers, could, of course, be


Horsepower of Motors Connected at Power Rates
Dec. 31, 1913
Total Increase for 1914 = 915 H.P.
Jan Feb Mar Apr May June July Aug. Sept Oct Nov. Dec.

THE VERIEST LAYMAN READILY COMPREHENDS THIS "THERMOMETER" DIAGRAM


Number of Motor Service Customers
Dec. 31, 1913
Total Customers Added in 1914
Jan Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec

A GRAPHICAL RECORD OF CONTRACTS CLOSED

added to the first sheet, and the second and third sheets then be done away with, but such an arrangement would not show the fluctuations of business from month to month, which has considerable interest to the power man.

Does the Genial Purchasing Agent Get the Salesman's Best Price?

By Malcolm Blakeslee

Every business man knows that to be successful a salesman must possess a pleasing personality; hence in the selection of their sales staff employers generally give preference to genial and likable applicants. In selecting men to be purchasing agents, however, the matter of personality is usually disregarded and men are selected chiefly on their qualifications as judges of the quality and prices of material. In fact, it has been considered best in some instances not to have too affable a purchasing agent. However, owners of some thriving electrical concerns are changing their views in regard to the requirements of the men who head their purchasing departments, because it has been discovered that, after all, salesmen are only human and that they will discommode themselves to render the best possible service to a courteous, friendly sort of man, even if he sit in the purchasing agent's chair.

Having come to a full realization of this attitude on the part of salesmen, an electrical manufacturer not long ago watched his own frigid purchasing agent greet, or rather acknowledge the presence of, the representatives of three other concerns. He noted the impersonal dealing and witnessed the hurried and none too courteous leave-taking of these salesmen, who had called regularly at that same place of business for several years. It was evident that the salesmen were glad to get out of this purchasing agent's office. After the last of the three salesmen had gone, the employer took aside the purchasing agent, who outside of his office was a genial fellow, and explained to him some new ideas on buying.

The next morning when the first salesman approached the purchasing agent's gate the former sphinx-like buyer rose from his chair, smilingly stepped forward to welcome the salesman, shook his hand, called him by name, and said, "Come in and have a chair. We're in the market for some of your product." In a business-like but pleasant tone the conversation proceeded to the question of price. When the price was quoted it was low—much lower than the same product had ever been bought in that factory before. The salesman had given the purchasing agent his rock-bottom price, principally because he was so dumbfounded at the change in the general attitude of the buyer, but partly because he wanted to quote his "best" price to a man with whom it was a pleasure to deal.

During the weeks and months that followed other salesmen came, were courteously received, and they, too, offered their goods at the lowest prices they dared.

The purchasing agent continued to treat visitors with courtesy, and he studied the salesmen who called. When the year was ended and the employer's new ideas in purchasing had had a fair trial, the company's books showed that the saving made by the purchasing department was quite comparable to the earnings of the sales department.

Installing a Complete Service in Fifteen Minutes

As one of the features of the annual field day and outing of the Commonwealth Edison Company of Chicago, service gangs from each of the company's three overhead districts competed in a service installation contest. The crew representing each district had previously been selected by elimination contests conducted in regular service-installation work during the two weeks preceding the field day.

Before the day of the final competition a pole line carrying primary wires on single arms was erected on the field. A platform on which three sections of brick wall were mounted was also erected at a distance of 75 ft. from the poles. Above it were placed three regular service outlets connected to groups of lamps. Each gang consisted of a foreman, two linemen and a groundman. The foremen were not allowed to do any work. Sitting in their trucks, which were loaded with standard tools and equipment, the men awaited the signal to start.

Conditions of the Contest

The rules of the contest required each crew to do the following work: Cut a gain and bore a hole for a buck arm on the pole; install the buck arm with braces and primary cut-outs; hang a transformer; connect the transformer to the primary circuit and to the service drop; install a bracket with three Pierce bolts on the brick wall; run a 75-ft. two-wire service from the pole to the bracket, and connect the service to the outlets. All joints were to be soldered and properly taped. The last thing to be done was to insert the primary plugs to light the lamps above the outlets, indicating that the work had been completed. Any failure to complete the job according to the company's standard practice was to result in a penalty equal to three times the time it would ordinarily take to do that part of the work. Any violation of the company's safety rules was to result in disqualifying the whole gang. Three judges with stop watches took the time and observed the work as it proceeded.

The Prizes and the Winners

In addition to the prize money offered to the winner of this contest as one of the regular field-day events, an

HANGING THE TRANSFORMERS ON THE TEMPORARY POLES AND RUNNING SERVICES

A NEARER VIEW OF THE "BRICK WALLS" TO WHICH THE SERVICES WERE ATTACHED

added bonus of 2 cents for each second under twenty minutes was provided for each man in the winning crew. The result of the contest was as follows: Northern District, Foreman Liesberg, fifteen minutes, forty-nine and one-half seconds; Southern District, Foreman Neilly, sixteen minutes, thirty seconds; Central District, Foreman Crawford, eighteen minutes, forty-four seconds.

None of the gangs was disqualified for violating the company's safety rules. The winning crew was, however, penalized fifteen seconds for spilling solder. The contest which was arranged under the direction of Mr. H. E. Wulfing, assistant superintendent of the overhead division, not only proved very entertaining but is declared to have increased the efficiency of the service crews both before and after the contest.

Distributing Fans in "Movies" to Advertise Electric Appliances

Most advertisers recognize the opportunities afforded for reaching a large number of people through the "movies," but the proprietors of these popular theaters, appreciating the same fact, have made their rates for

ADVERTISING ELECTRIC APPLIANCES TO "MOVIE" PATRONS

screen space so high that such advertising is expensive. The Electric Shop of the United Electric Light & Power Company, New York, has obtained all of the advantages of "movie" publicity, in addition to those of other forms of advertising, by reverting to the time-honored plan of having advertising fans distributed in the theaters. These are welcomed by frequenters of the movies in hot

weather, and since one side of the fans bears an attractive picture in colors, devoid of all advertising, they are usually taken home by the recipients. For this reason, such advertising is of greater value than that shown on screens for only a few seconds. Furthermore, the advertiser has to pay only for the printing and lithographing of the fans and not for advertising space. Forty thousand fans of six different designs have been prepared at a cost of $8.50 per thousand. The particular fan shown in the illustration calls attention to a special sale on $3 electric irons. Mr. J. V. Gilfoyle is manager of the appliance department of the United company.

Police Call-Box Keys for Arc-Lamp Patrolmen

All of the arc-lamp patrolmen in an Eastern city are provided with keys which open any police-telegraph box. If a lamp is discovered "out" and assistance is needed for its repair, the inspector can go to the nearest police-call box and there communicate with the central-station headquarters. Permission to use the police-call boxes in this way was obtained after the value of electric lighting in facilitating the policing of the city had been pointed out to officials of the city department.

Telling Phrases in Appliance Advertising

The simplest form of expression is always the most effective in presenting selling arguments to the prospective customer. The same rule applies to the sale of electric irons to housewives. As a model of clear presen-

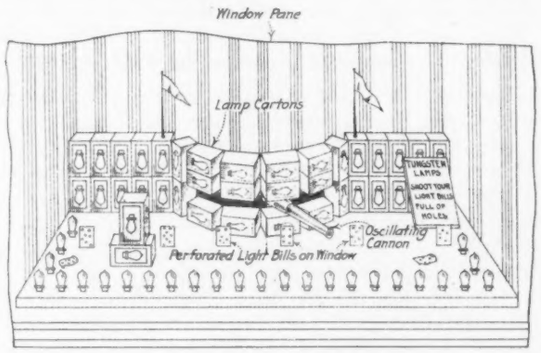
Keep Your Kitchen Cool This Summer
Electric Flat Iron
Puts the Heat Right on the Clothes
Electricity Heats the Iron Only—It Does Not Heat the Handle, the Room, or You
With a long cord you can take your ironing out on the back porch or to any cool place. No running back and forth for hot irons—and the Breeze that cools you does not cool the iron.
Phone Us for One by Quick Delivery
$2.50
The Edison Electric Illuminating Company of Boston
Addresses and Phones of 18 Stores

NEWSPAPER "AD" OF BOSTON EDISON COMPANY

tation, without waste of words or space, the advertisement of the Boston Edison company reproduced herewith will bear study by the man who has "ad copy" to write for his local newspapers. This advertisement appeared in papers in the Boston suburban district during the weeks ended July 24 and 31. Copies were also furnished to local electrical dealers to be posted up in their display windows during the same period.

War-Time Window Display of Lamps and Cartons

A cannon made of cardboard and mounted with its muzzle protruding from a fort built of lamp cartons formed the attractive window display used recently by the Pritchard & Sours Electrical Company, Watertown, S. D. Concealed inside the cannon, near its mouth, was a 200-watt tungsten lamp the light from which could be seen projected clear across the street at night. To simulate firing of the cannon the lamp was controlled by a flasher. The rear of the gun was attached to the guard of an oscillating fan, which was used to blow air out through the cannon, thus cooling the lamp and at the same time keeping in motion colored streamers attached to the muzzle. A row of electric-service bills punched full of holes was hung in the



A WINDOW DISPLAY THAT CAUGHT THE ATTENTION OF THE PASSER-BY

window with a placard reading, "Mazda lamps shoot your whole place full of light."

The cannon was made of black cardboard 24 in. wide tacked onto two wooden rings. The larger ring measured 6 in. in diameter, and the one at the muzzle 2.5 in. in diameter. The foreground of the window was covered with green crêpe paper to imitate grass, and the remainder of the display was finished in blue and white.

Enlisting Employees' Interest in New Contracts Closed by Dayton Central Station

Mr. Thomas F. Kelly, commercial manager of the Dayton (Ohio) Power & Light Company, believes in the policy of keeping the employees of his company informed concerning new contracts which the company secures for both motor and lighting business. To this end he has had posted on bulletin boards placed in the company's salesroom and offices typewritten announcements giving data on important contracts entered into by the company, as these are completed.

A standard form is used, giving the name, location, conditions of contract, total connected load, lighting load and estimated energy consumption of the new consumer. As a result of this practice of posting new-business announcements, all the employees of the company—those in the non-commercial divisions as well as those in the sales department—show the liveliest interest in new contracts for Dayton Power & Light Company service.

NEW CONTRACT SECURED BY DAYTON POWER & LIGHT COMPANY

NAME	The Miami Hotel Company.
LOCATION	Second and Ludlow Streets.
TERM OF CONTRACT	Thirty years.
TOTAL CONNECTED LOAD	328 hp.
LIGHTING LOAD	100 kw.
ELEVATORS (electrically operated)	Three high-speed passenger. One freight.
CONSUMPTION PER YEAR (estimated)	850,000 kw.-hr. 18,500,000 lb. of steam.
REMARKS	We will also operate two 30-ton refrigerating machines and two 150-gal. pumps. We are to supply the hotel with its entire steam requirements for heating and cooking. The hotel grill rooms will be cooled by means of refrigerated air, enabling the rooms to be kept at an even temperature.

STANDARD FORM OF BULLETIN

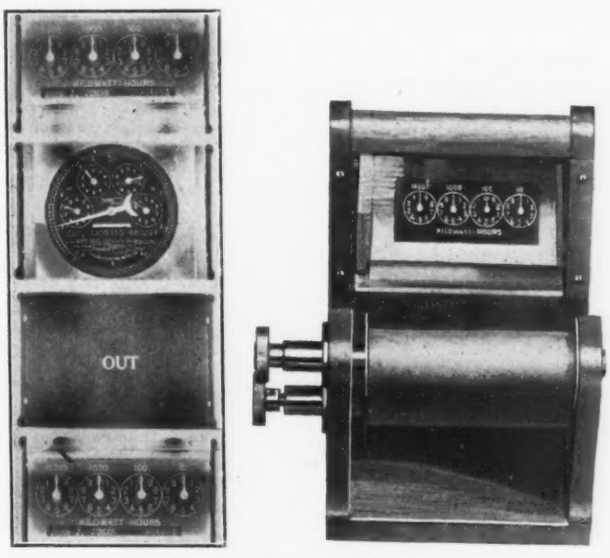
NEW APPARATUS AND APPLIANCES

A Camera for Reading Customers' Meters

A special camera has been developed by the Folmer & Schwing division of the Eastman Kodak Company, Rochester, N. Y., for the use of men on meter-reading routes, who are thus enabled to bring into the office at the close of the day's work photographic evidence of

ELECTRIC-LIGHTED CAMERA FOR RECORDING METER READINGS

the positions of the dial pointers on the meters of the customers visited. To "take" the reading the meter man simply holds the camera opening against the meter dial glass and presses a lever, which automatically opens the shutter for a definite period and at the same time lights four small battery-operated lamps to illuminate the meter dial. After each exposure is made, the shutter is locked and cannot be operated again until the film roll has been advanced to the position for the next picture. The device can also be used as a hand-lantern in dark passage ways by pressing the lever part of the way down without operating the shutter.



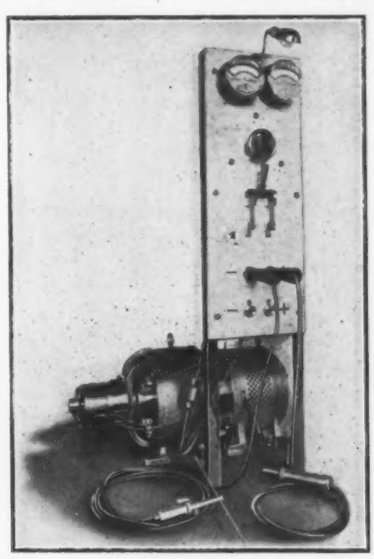
SAMPLE FILM, AND ROLL STAND FOR EXAMINING READINGS

Each roll of the special "film" used provides for seventy-five exposures and costs 25 cents. Two additional rolls can be carried inside the camera box, making a total of 225. The "film" on which the pictures are taken consists of an emulsion on opaque paper, which is backed up with a white coating that makes details of the developed film show up clearly although reversed right and left, mirror-fashion. This reversed film is then examined by mounting the rolls in a special stand and reading the reflection in a mirror. As the customer's name and meter number are marked on each dial, the photograph leaves no doubt of the identity of the reading. If the customer is "out," the meterman notes this fact on a card and photographs it for his film record.

The "Factograf" camera, as it is called, provides a definite photographic record of the condition of the customer's meter and avoids all possibility of misreadings or future controversies. Especially useful is such evidence, it is pointed out, in the case of maximum-demand meters, where, ordinarily, the meter reader notes the position of maximum-demand pointer and then sets it back to zero, thus destroying all future record of its position, unless this is photographed as with the meter-reading camera. Including developing, it is estimated that the total cost of reading meters with the "Factograf" camera will not exceed 0.5 cent per exposure. The camera weighs about 8 lb. and is leased to the user for $22.50. Preliminary experiments with the meter-indexing camera have been conducted on the lines of the Rochester (N. Y.) Railway & Light Company, and the latter is employing these cameras on several of its regular meter-reading routes beginning with the month of August.

Arc Welder

In the accompanying illustration is shown a complete electric arc-welding outfit recently placed on the market by the Lincoln Electric Company, Cleveland, Ohio. The set includes a motor-generator outfit, switchboard with instruments and switching equipment, and carbon and metal electrodes. The motor of the motor-generator set may be either an alternating-current or a direct-current



ARC-WELDING OUTFIT

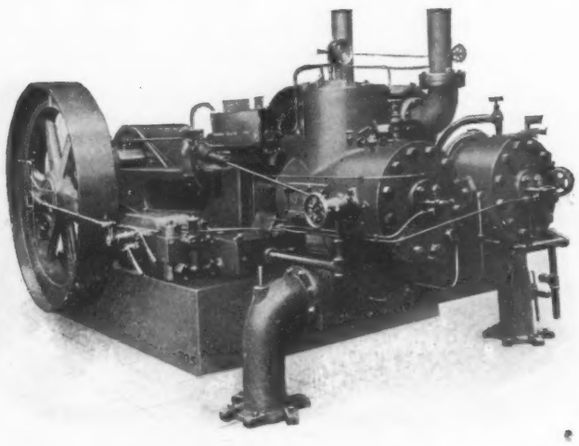
machine. The generator is a direct-current machine which is so designed that the energy delivered at the arc will always be of the proper voltage for welding. On this account, the manufacturer points out, no resistance is necessary in the circuits to cut down the voltage, and therefore no power is wasted.

High-Compression Oil Engine

Two-stroke-cycle oil engines of the high-compression type with ratings of from 50 hp. to 200 hp. are being built by the Nordberg Manufacturing Company of Milwaukee, Wis. Ignition is obtained by the heat of the highly compressed air, as in the Diesel engine. The compression pressures are about 450 lb. The fuel is injected mechanically by a small pump which discharges through an atomizing head.

In the accompanying illustration is shown a 200-hp. two-cylinder engine from the fuel-pump side. The head of the engine is a simple symmetrical casting in which there are no valves. The only valve on the engine is a piston valve for scavenging air which is above and between the cylinders in the 200-hp. size shown in the illustration. One valve controls the scavenging air for the two cylinders. Air is compressed on the crank side of the piston and by-passed to the head end, shortly after the uncovering of the exhaust valve, thus forcing the burnt gases out of the cylinder and filling it with fresh air. Compression and combustion then take place. The air intake is through the vertical pipes above the engine, and the exhaust through pipes going through the floor.

The engine is started by rocking an air valve which turns the engine over and at the same time throws in two auxiliary air cams which thereafter admit air at the proper points in the stroke to each of the two cylinders. The starting air is stored in a steel tank, at a pressure of 250 lb., the air being obtained from a small



200-HP. TWO-CYLINDER HIGH-COMPRESSION OIL ENGINE

auxiliary compressor. When the engine comes up to speed one of the cams is thrown out and at the same time the fuel pump is thrown into action by one of two levers on the same side of the engine. As soon as the cylinder fires, the air cam for the other cylinder is thrown out and the second fuel pump is thrown into gear; the engine is then under control of the governor.

The fuel pumps operate in a bath of lubricating oil. The oil is drawn from the storage tank to a small strainer box to the right and behind the pumps from which it flows to the main fuel pumps. A small heating coil, through which heated jacket water circulates, is contained in the main oil compartment of the strainer box to insure free flow of very viscous oils. The pumps are operated by cams driven by an eccentric and deliver a quantity of oil in excess of that required for maximum load, the governor acting to by-pass more or less of the fuel according to the load that obtains. The by-passed oil is discharged through a sight glass, giving the operator a quick check on the working of each of the pumps. The governor is of the flywheel design and provides regulation of 2 per cent from no load to full load. From the fuel pumps the oil is discharged through small pipes to the atomizer heads bolted to the main cylinder heads.

The lubricating system of the engines is entirely automatic, oil being fed from a central pump driven from the scavenging valve eccentric. Cylinder oil is pumped to the scavenging air valve and to the main cylinders. Bearing oil is pumped to all the main bearings, to the crosshead pins through trombone oilers, and to all auxiliary bearings. The cranks are inclosed by polished-iron guards. The oil accumulates in the crank case from various parts of the engine and is drained to a filter and returned to the lubricator.

Induction-Motor Starters

Starters for squirrel-cage induction motors which in their method of operation resemble drum-type controllers have recently been placed on the market by the Crocker-Wheeler Company, Ampere, N. J. The complete

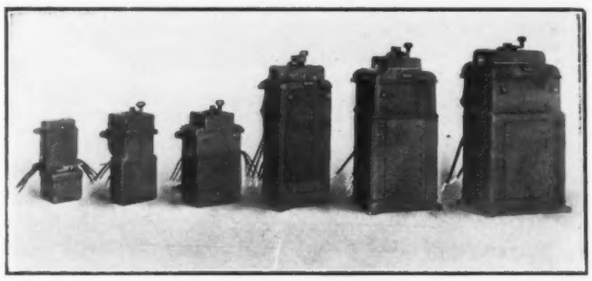


FIG. 1—VARIOUS SIZES OF INDUCTION-MOTOR STARTER

starter includes a transformer case at the bottom of which is mounted an overload relay. Immediately above is the oil vessel with a hinged cover, which can be turned upward through an angle of 90 deg., so that the switch attached to the under side will be exposed to view for inspection and repair. Near the center line of the pivots on which the cover turns is the web of cables connecting the switch to the other parts of the circuit. The oil-tank cover is surmounted by a smaller cover, under which are the voltage release magnet and other parts of the handle mechanism, and at the extreme top is the handle. In Fig. 3 the starter is shown in its operative position, and in Fig. 4 in position for inspection.

The connections to the switch are made from below. The entering leads pass upward through a sealing compartment, from which they emerge at about the level of

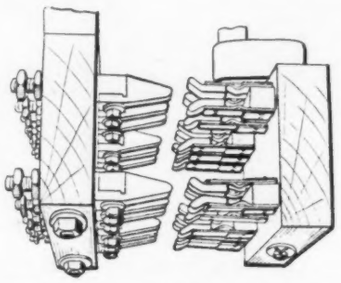
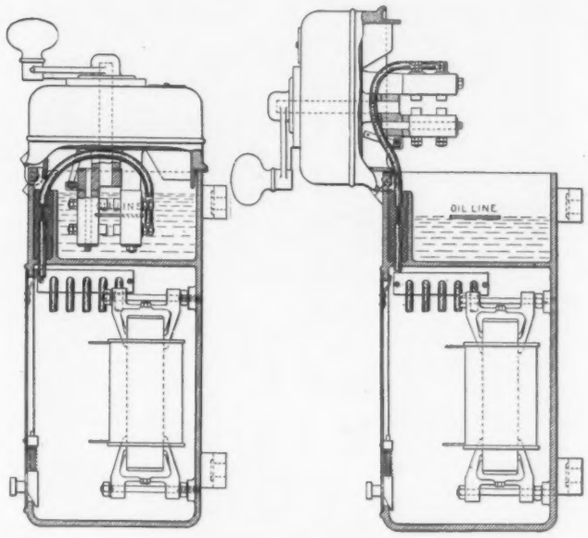


FIG. 2—SWITCH WITH WEDGE-SHAPED CONTACTS

the oil in the tank. The leads are then bent in a semicircle of large radius so that they enter the oil against the side of the tank opposite the sealing compartment. The switch is provided with a horizontal break which consists of two wooden boards, one stationary, the other

movable. The stationary board carries the terminal studs to which the cables are connected. The other ends of the studs carry the contact-making parts, which project toward the moving board. The moving board carries corresponding contacts. There are no connections



FIGS. 3 AND 4—STARTER IN POSITIONS FOR OPERATION AND FOR INSPECTION

between the moving contacts and the entering cables except when they are forced together by the operation of the switch. The contact boards are moved together by a crank on which the moving board is hung. The moving board is kept from turning by itself about the crank by a long U-shaped guide link so that it always faces squarely toward the fixed board, regardless of the position of the crank.

larger starters, a similar effect in a higher degree is obtained by the wedge-shaped contacts.

The starter is designed especially for two-phase machines, but by connecting pairs of wires together it may also be used with three-phase motors. A feature of the starter, the manufacturer points out, is the housing of the voltage-release mechanism and other parts in the strong iron box at the top of the starter directly under the handle. The following advantages are claimed for the starter: Accessibility for inspection and repair, switch parts exposed for inspection at a convenient height in plain view; no vulnerable parts exposed to external injury; horizontal-break oil switch permits contacts to discharge worn-out particles of metal; large sizes can be made for floor mounting without sacrificing accessibility.

Direct-Contact Feed-Water Heater

Two features of the direct-contact or open feed-water heater which the manufacturer, the National Pipe Bending Company, New Haven, Conn., calls attention to are the contact pipes and the filter. The heater is usually cylindrical, but it may be square when the conditions of installation make this form preferable. In either case the contact pipes are horizontal, and they extend from one end of the heater to the other, each pipe being in reality a double cast-iron pipe, the larger part containing steam which completely surrounds the smaller, which is always filled with feed water. The pipes are not concentric but, as shown in the accompanying illustration, are virtually tangent. The water enters the heater through the smaller pipe, and while within the pipe it is warmed by surface contact because the water pipe is surrounded by steam. The water overflows the port at the top and flows around the larger pipe in the form of a thin film which is warmed both by the hot walls of the steam pipe and also by actual contact with the exhaust steam which fills the heater. The film of water breaks

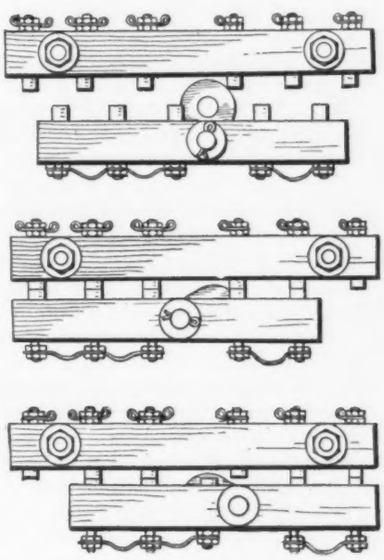
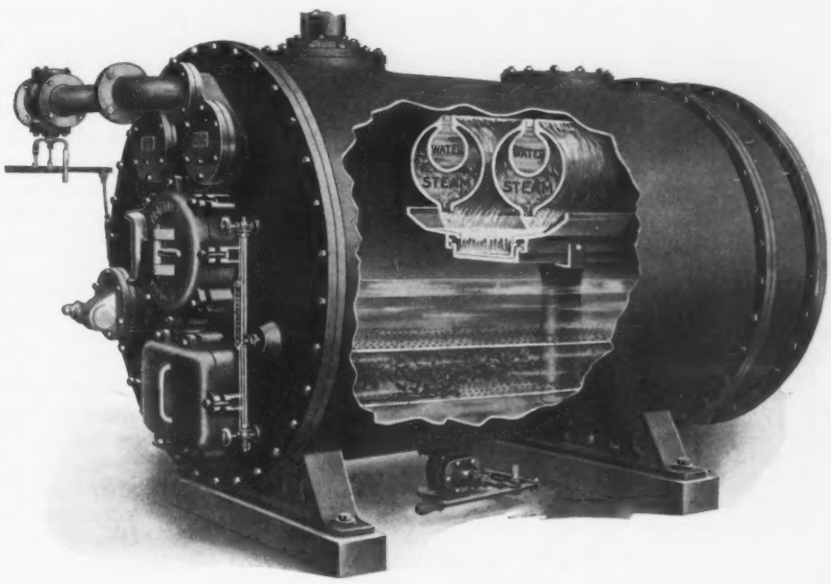


FIG. 5—SWITCH IN "OFF," "START" AND "RUNNING" POSITIONS



DIRECT-CONTACT FEED-WATER HEATER AND FILTER

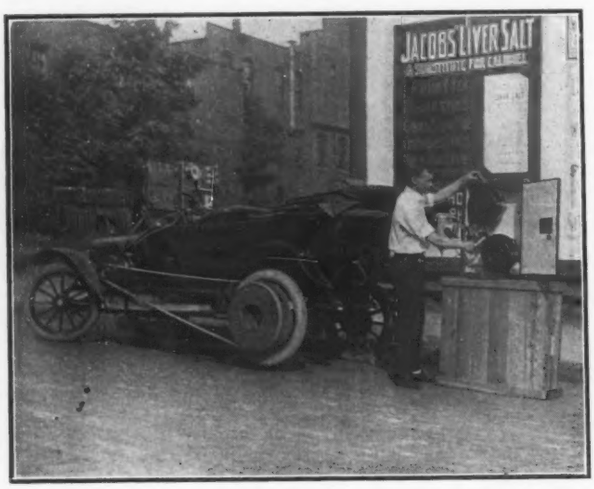
In Fig. 5 is shown a view of the switch looking from the bottom upward in the "off" position, closed in the "start" position and in the "run" position. The parts are so placed that as the switch closes the contacts are rubbed together and the contact surfaces are kept clean. With the switch shown in Fig. 2, which is used in the

up into two sheets of fine spray when it reaches the bottom of the pipe, and while in this form the water mingles with the exhaust steam which passes through it in escaping from the larger pipe. This intimate mingling of the water and steam heats the water to the temperature of the steam.

Filtration is upward instead of downward, so as to relieve the filter bed from unnecessary work. Because of the large storage capacity, the hot water beneath the filter bed need not travel at great velocity and there is time for the sediment and impurities to settle. What impurities remain are caught on the under side of the filter bed. With this arrangement, the water is pumped from above the filter bed, and there is no danger, therefore, of the filter material being carried over to the pump, even though the supporting plates should give way. By means of upward filtration a relatively small amount of sediment is caught on the filter bed so that its life is comparatively long. Provision has also been made for quick cleaning by a reverse flow through the heater, a quick-acting valve being installed for the purpose. An oil separator is also provided for removing oil from the exhaust steam before it enters the heater.

Portable Motion-Picture Apparatus

An interesting portable outfit for showing motion pictures has been developed by Mr. W. H. Weingar, district salesman for the Maxwell Motor Sales Corporation, Columbus, Ohio, for use in showing motion-picture scenes from the Maxwell factories. The apparatus, which is shown in the accompanying illustration, includes a Robbins & Myers 110-volt direct current flywheel-pulley generator which is belted to a 24-in. pulley attached to the left rear wheel. The generator is mounted on a 2-in. plank on the running board at the front of the automobile, as shown in the illustration. To operate the motor, the rear wheels are raised before the belt is connected to the pulley, power being obtained from the automobile engine. A switchboard is mounted on the wind shield of the car and is equipped with a voltmeter, field rheostat, switch, and three receptacles. One of the receptacles is for a switchboard lamp, another for the motion-picture machine, and the remaining one for a Robbins & Myers fan, which is usually placed in front of the engine radiator to cool

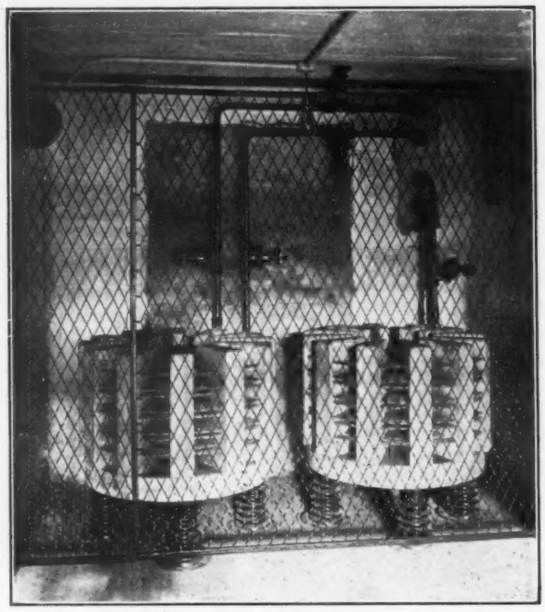


MOTION-PICTURE OUTFIT OPERATED BY AUTOMOBILE ENGINE FROM REAR, WHICH IS RAISED

the motor. The motion-picture machine is mounted on the front end of a scenery wagon, and at the rear of this wagon there is a framework to which a screen is attached. The picture machine is of the Motion-Scope make and is operated by a 500-watt incandescent lamp which is said to give a very satisfactory picture up to a projection distance of 60 ft. or 70 ft.

Fireproof Current-Limiting Reactors

Current-limiting reactors of fireproof construction for various circuits have been developed by the General Electric Company, Schenectady, N. Y. The winding consists of bare stranded cable, two cables being ar-



TWO-PHASE INSTALLATION OF FIREPROOF CURRENT-LIMITING REACTOR

ranged in multiple. It is wound in conical layers and is supported by a compound which is cast or molded around the conductor. The conical layers are said to provide increased spacing with increased difference of potential between the adjacent portions of the windings.

The manufacturer states that the cast construction gives the necessary mechanical strength without using through-bolts from the top to the bottom of the coil; thus the surface insulation is a maximum between the points of maximum difference of potential—that is, the top and bottom of the coil. The bare conductor is used in order to eliminate any inflammable or combustible insulating material which might, under abnormal conditions, reduce or destroy the dielectric strength of such materials by overheating. The bare conductor also furnishes perfect ventilation of the winding, eliminating any thermal gradient between the energy-carrying parts and the cooling air. Stranded cable is employed to insure uniform distribution of electrical energy in the conductor.

The composition of the supporting structure is such, it is declared, that the structure acts as a distributed resistance, shunting the reactance, insuring a uniform voltage distribution between turns and layers, and removing the possibility of concentration of high voltage at high frequency over any small portion of the winding. The manufacturer also asserts that the high-frequency discharge which may occur at the creation of a short-circuit is dissipated uniformly. The reactor is supported by porcelain posts, the surfaces of which are corrugated to provide against a discharge of high frequency to the ground. The terminals are brazed to the conductor. In the accompanying illustration is shown a two-phase installation of the cast-in type of current-limiting reactors. After being installed, the terminals of the generator were short-circuited to the reactors, and the reactors worked perfectly, it is claimed, without any flashing between turns and layers.

CURRENT NEWS SECTION

Convention of Sales Managers

As mentioned in last week's issue of the ELECTRICAL WORLD, sales managers of the larger companies connected with the Association of Edison Illuminating Companies held their fifth annual convention at the Passaconaway Inn, York Cliffs, Maine, on Aug. 2 to 4. The attendance was the largest that has been registered at any of the meetings.

The meeting was called to order at 8 p. m. on Aug. 2 by the chairman, Mr. A. A. Pope, assistant general commercial manager of the New York Edison Company. During the sessions the following papers were presented and discussed:

"Report on a Test of a Private Plant," Mr. E. F. Tweedy, New York Edison Company; "Cost of Electric Energy from a Private Plant," Mr. H. H. Holding, Public Service Electric Company, Newark; "Development of the Electric Furnace," Mr. E. L. Crosby, Edison Electric Illuminating Company, Detroit; "Report of Committee on Sales Department Costs," Messrs. R. S. Hale, chairman, Douglass Burnett, T. I. Jones and E. W. Lloyd; "Decorative Lamp-Posts, Their Influence in Lighting a City and on a Company's Revenue," Mr. T. I. Jones, Edison Electric Illuminating Company, Brooklyn; "Electrically Heated Japanning Ovens," Professor Hirshfeld and Mr. W. D. Dygert, Edison Electric Illuminating Company, Detroit; "Electrical Appliances, Merchandising and Central Stations," Mr. J. D. Guilfoyle, United Electric Light & Power Company, New York; "Importance of Proper Sales Effort on the Part of Inside Store and Office Employees," Mr. C. E. Robertson, Consolidated Gas, Electric Light & Power Company, Baltimore; "Concentric Wiring and Its Effect on Getting Additional Business from Unwired Properties," Mr. R. S. Hale, Edison Electric Illuminating Company, Boston; "Graphical Methods for Accumulating Sales Department Statistics," Mr. John Meyer, Philadelphia Electric Company; "Remarks on Two Policies of Selling Appliances," Mr. J. F. Kelly, New York Edison Company.

One of the innovations was an open session at which various topics were brought up for discussion. This proved to be one of the most interesting features of the convention. Chairman Pope appointed the nominating committee, as follows: Miss S. M. Sheridan, chairman, and Messrs. E. W. Lloyd and J. C. McLaughlin. The report of the committee was adopted unanimously and the following officers were elected for the next convention: Chairman, Mr. Joseph D. Israel; members of the executive committee, Messrs. F. D. Beardslee, Union Electric Light & Power Company, St. Louis, and C. E. Robertson, Consolidated Gas, Electric Light & Power Company, Baltimore. The following attended the convention:

Messrs. C. E. Robertson, Consolidated Gas, Electric Light & Power Company, Baltimore; R. S. Hale, L. R. Wallis and W. G. Stetson, Edison Electric Illuminating Company, Boston; T. I. Jones and H. G. Disque, Edison Electric Illuminating Company, Brooklyn; E. W. Lloyd, Commonwealth Edison Company, Chicago; H. H. Holding and F. D. Pembleton, Public Service Electric Company, Newark; A. A. Pope, E. F. Tweedy, J. F. Kelly and Charles K. Nichols, New York Edison Company; J. F. Becker, A. F. Berry and J. V. Guilfoyle, United Electric Light & Power Company, New York; Joseph D. Israel and John W. Meyer, Philadelphia Electric Company; F. D. Beardslee, Union Electric Light & Power Company, St. Louis; John C. McLaughlin, H. A. Brooks and W. K. Handy, Potomac Electric Power Company, Washington; Miss S. M. Sheridan, Mr. Edward L. Crosby, Miss Florence Nowell and Mr. Herbert Silvester, Detroit Edison Company. Messrs. Parker H. Kemble and Charles A. Barton of the Queens County Electric Light & Power Company were present as guests.

Cincinnati Rate Case

The hearing on the tentative valuation of the physical property of the Union Gas & Electric Company of Cincinnati, Ohio, for the purpose of rate-making was resumed before the Ohio Public Utilities Commission on Aug. 3. Mr. W. J. Norton examined witnesses and took the stand. Attorney Lawrence Maxwell of Cincinnati conducted the direct examination. City Solicitor Walter M. Schoenle represented the city of Cincinnati.

Much of the day was spent in the discussion of depreciation, on which there is a wide difference. Solicitor Schoenle contended that the commission's estimates were not sufficiently high, while the company's representatives argued for the opposite view and gave their reasons. The following table was used:

	Company Estimate		Commission Estimate	
	Per Cent	Amount	Per Cent	Amount
Buildings	8.96	$117,980	17.00	$213,271
Power-plant equipment	13.40	342,546	20.14	496,722
Substation equipment	2.72	17,829	15.20	112,312
Underground equipment, except services and street lights	2.20	43,692	12.00	223,331
Underground equipment, services and street lights	2.60	6,219	17.65	29,863
Overhead, except services and street lights	6.80	108,741	17.81	231,906
Overhead, services, meters and street lights	5.40	42,705	25.72	172,153
General, furniture, transportation equipment	16.40	10,630	27.10	16,596
General stock and supplies	5.29	11,534	24.23	61,884

City Solicitor Schoenle insisted on information regarding an earlier inventory that had been filed with the commission. Mr. Norton explained that this inventory is incomplete and unsatisfactory. The company has rejected the first inventory.

Testimony was given by Messrs. Paul W. Bird and Bert L. Baldwin, engineers, who upheld the correctness of the depreciation items presented by the company. Mr. Bird contended that in many features the present plant will last as long as a new one. Mr. Baldwin asserted that the various properties are maintained in a good state of repair and this reduces the depreciation item.

Mr. Bird and City Solicitor Schoenle differed on the item of contractors' profits. Mr. Schoenle contended that no profits should be considered on pieces of equipment installed directly by the company, but Mr. Bird, in building up a theoretical plant new, said that these items must be included. He also said that the physical value of the property should be taken as a going con-

cern. There were arguments over the depreciation on overhead items.

Mr. C. R. McKay of the company testified on the second day of the hearing regarding the value of water leases and cost of developing business. Mr. Schoenle contended that there was no element of value in the water leases.

Solicitor Schoenle filed a motion to strike out all the evidence that had been presented about piecemeal construction and the establishment of depreciation by the restoration method. Chairman Waltermire, however, overruled the motion and announced that the record would show no ruling until the final disposition of the case.

Testimony regarding intangible values was offered by Engineer Norton. Mr. Norton said that less energy is used in Cincinnati compared with its size than in any other city in the country. This is due to the cheap gas and the conservatism and thrift of the people, the older residents especially looking upon electricity as a luxury. The electric properties are operated on a high plane of efficiency, and excellent service is furnished. The cash balance as an element of working capital should be equal to 5 per cent of the total yearly income, he said, or $86,815, instead of the $30,000 which the commission has allowed. The company has worked on less than the amount named, but Mr. Norton said that the business is not satisfactory on so small an amount.

When Solicitor Schoenle asked for actual figures on the cost of attaching business, Mr. Maxwell informed the commission that the accounts for this item had not been kept separate from the general accounts. The commission had fixed upon $15 as the cost of securing each of the 20,292 customers on the company's books. Mr. Norton estimated the cost of securing 9000 residence customers at $40 each, 7995 commercial customers at $75 each, retail motor-service customers at $100 each, and 427 wholesale motor-service customers at the lump sum of $320,000. The total cost of securing the business had been placed at $1,500,000 by the company, and Mr. Norton said that it would be justified in spending that amount to increase the number from 20,000 to 40,000.

Mr. James M. Hutton of W. E. Hutton & Company, brokers, testified as to the cost of financing a company. He said that, in order to raise $10,000,000 for building and equipping a light plant, it is necessary to issue securities of $13,000,000 or more. It would be impossible to finance the property entirely on bonds, he said. The company has fixed $2,500,000 as the cost of financing. The hearing was adjourned to Sept. 22.

The No-Referendum League filed petitions containing 1176 names with the commission on Aug. 5, asking that it assume jurisdiction over the light rate in Cincinnati. A hearing is set for Sept. 10.

City Solicitor Schoenle has prepared an ordinance appropriating $8,500 for a valuation of gas properties of the Union Gas & Electric Company.

The final word in the history of the Diamond Light Company, which established a block plant in the heart of Cincinnati some months ago and started a fight on the city and the Union Gas & Electric Company, is about to be written, as receivership proceedings have been brought against the company by creditors, following the announcement by Vice-president J. M. Wikel that the company will wind up its business. Court decisions have restricted its operations to an area of only one-fourth of a block, as it is not permitted to cross streets or alleys, and since it has only fifteen consumers the operation of a plant which cost $40,000 is not remunerative. The Evans Oil Company is one of the creditors asking a receivership, alleging a total indebtedness of about $10,000.

Newspapers and the Public

In a recent address before the Norfolk (Va.) Rotary Club, Mr. E. C. Hathaway, assistant general manager of the Virginia Railway & Power Company, discussed "Corporations and Municipalities and Their Reciprocal Relations." During his remarks he spoke of the daily press, but said that his statements were not made in the way of unkind criticism, but only to sustain his point. The public service corporations are the only clients of the press who pay their good money for advertising space and at the same time are criticised unmercifully by men whose knowledge of the business criticised is on a par with their familiarity with Hebrew or Sanskrit. Paraphrasing Lincoln's saying, Mr. Hathaway added: "You can please part of the people all of the time; you can please all of the people part of the time, but you cannot please all of the people all of the time."

Public service companies, in the last analysis, Mr. Hathaway declared, are business ventures, selling public necessities, all entering into our daily life. As they are always before the people, criticism is natural. It is unfortunate that in the majority of cases the stock in these companies is not held locally; theoretically it should be held in the cities in which they operate. In the majority of cases electric railways, lighting plants and gas companies were originally local concerns and were only fairly successful at first. The rapid growth of the towns in which they operated made large expenditures necessary for extensions, betterments and improvements. The financing could not be done locally, and as a result the stockholders sold out, usually at good profits, to syndicates that had the money-raising ability.

On the subject of what the corporations owe the public, Mr. Hathaway said that the obligation is clear. They owe the best possible service that can be given, consistent with a fair return on the capital invested, plus the proper up-keep of the property. Proper up-keep means the adoption of every modern device and improvement which makes for economy both to consumer and the company and efficiency. Good service does not mean just the quality and quantity of the product, but its delivery to the consumer, the constant supervision of delivery to insure satisfaction, and proper hearing and attention for all just complaints. Education and thought are doing for the companies what they could not do for themselves; therefore it behooves them to help this education by getting out into the open and telling the people what they are doing, what they are trying to do, and what they expect to do in the future.

Light as a Crime Deterrent

Interesting testimony from police officers on the value of street lighting in protecting property was brought out in a recent hearing at Kansas City before a special commissioner appointed by the Supreme Court. The police department has been demanding $650,000 from the city, while the administration has contended that it could spare only $550,000 for the fiscal year.

The police department is under State control and is supposed to receive whatever it requires from the city; hence the hearing before the commissioner to ascertain the equity of the situation and the good faith of the police commissioners in asking the larger sum.

Captain Thomas P. Flahive, credited with being the best informed person in Kansas City on police matters, declared that street lamps were quite as important as policemen. He suggested, in effect, that the need of policemen was almost in inverse ratio to the number of lighted lamps in residence and business districts.

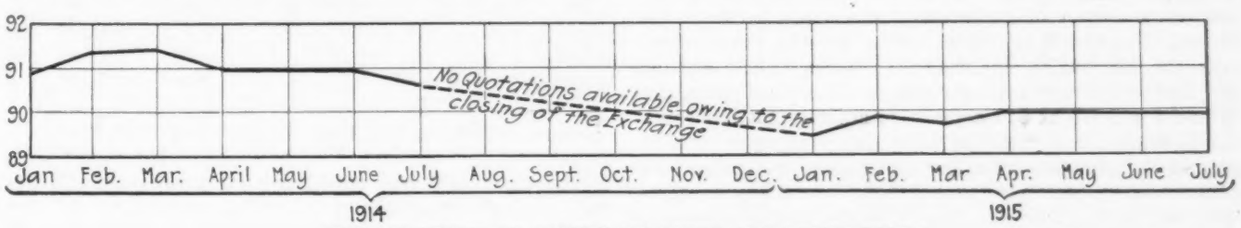
Trend of Light and Power Bond Prices

While bond prices are not so quick to reflect panicky conditions as stock prices, they do show the effect of long periods of depression. Being a commodity in the financial market, they are subject to the economic law of supply and demand.

To illustrate the effect of the first year of depressed conditions brought about by the European war, the prices of ninety-six bond issues of representative light and power companies were averaged monthly, from January, 1914, through July, 1915. The prices were taken from the quotations of exchange all over the country and represent as nearly as possible the bid prices on the last business day of the month. Care was taken to choose companies well scattered so that a majority should not come from any one section of the country.

The total par value of the bonds represented that are now outstanding is more than $375,000,000. This is roughly 36 per cent of the aggregate par value of all American light and power company bonds. In but few cases were more than one issue of a company included in the averages. Where more than one issue was made, the price of the first mortgage bonds was taken.

The accompanying curve shows graphically the average prices from January, 1914, to July, 1915. During the period from June 30 to Dec. 18 the New York Stock Exchange was closed. While some bond business was done in November, it was not possible until January to obtain bond quotations from all of the exchanges. For this reason the period from July to January in the curve is indicated by a dotted straight line. Undoubtedly the conditions were different from that represented by the dotted line, but no information is available on the exact condition.


92
91
90
89
No Quotations available owing to the closing of the Exchange
Jan Feb. Mar. April May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar Apr. May June July
1914
1915

AVERAGE PRICES OF NINETY-SIX LIGHT AND POWER BONDS

As will be noticed, the average price for ninety-six bond issues at the close of business January, 1914, was 90.8, while at the close of business a year later it was 89.4, a drop of 1.4 points, or 1.54 per cent. From January, 1915, to the close of business last July there was a rise in prices, the gain being 0.4 point. At the end of the first twelve months of the war the average price was 89.8, or just one point below what it was in January, 1914.

Starting with January, 1914, bond prices improved and the average price rose to 91.4, then dropped to 91 for three months, and fell to 90.6 on the beginning of the war. Comparing the price of 90.6 at the beginning of the war with the price of 89.8 twelve months later, the depreciation is found to be but 0.88 per cent. Since the exchanges opened the average price has improved 0.4 point, or nearly 0.45 per cent.

Particular attention may, therefore, be called to the stability of public utility bond prices. Over the entire period here shown of nineteen months the difference between the high average price of 91.4 and the low average price of 89.4 was but two points. The average price of average prices over the entire period was 90.3, so that the maximum deviation from the nineteen months' average was, for the high, 1.1 points, and, for the low, 0.9 point.

For the sake of a further comparison, attention is called to the fact that railroad bonds are now at their lowest value of the past five years. A compilation made by the *Wall Street Journal* of twenty-five representative railroad bonds disclosed an average price at the close of business of July, 1915, of 77.21, against 86.82 in January, 1914, a drop of 9.61 points, or 10.7 per cent, showing that electric light and power bonds for the past nineteen months were ten times steadier than railroad bonds.

Public Service Commissions in New York Constitution

A letter has been sent to the committee on public utilities of the New York Constitutional Convention by the sub-committee on public utilities of the committee of engineers representing the following societies: American Society of Civil Engineers, American Institute of Electrical Engineers, American Society of Mechanical Engineers, American Institute of Consulting Engineers, New York Section of the American Institute of Mining Engineers, Municipal Engineers of the City of New York and Brooklyn Engineers' Club. The sub-committee on public utilities is composed of Messrs. Charles Whiting Baker, chairman, W. W. Brush, Gano Dunn, Charles Hansel and James E. Sague, although only the first three members signed the report.

What the committee considers of greatest importance is the preservation of the principle of continuity already established in the present Public Service Commissions whereby the terms of office of the members expire at different times, so that only one member of the commission at a time goes out of office.

The committee also urges the embodiment of some provision in the constitution setting forth the general qualifications which candidates for the position of commissioner should possess. There is no doubt that State and federal control of public utilities is here to stay, but it is a serious question whether these great powers of control will be exercised so wisely and justly that the public will be satisfied and the public-utility corporations may be able to continue in business and meet the requirements placed upon them. The vast responsibilities placed upon the commissions are hardly realized as they should be. Upon their proper handling of the very difficult questions before them depend the welfare, the prosperity, the safety of millions of people.

Many of the appointments to State public-service commissions, the committee adds, have been of men who had not sufficient experience or ability to fill these positions properly. The committee therefore proposes the requirement that any man appointed to membership "should have had experience in connection with public utilities which would fit him for the duties of his office."

The last recommendation of the committee is that there should be one public service commission for the whole State instead of two, it being understood that the work of constructing and administering the New York City rapid-transit system would be transferred to the city and would cease to be a State function.

Government Control of Sayville Radiotelegraph Station

The action of the Navy Department in taking over recently the operation of the Sayville (L. I.) wireless-telegraph station of the Atlantic Communication Company (Telefunken system), which is in direct communication with Nauen, near Berlin, followed the publication of articles in the daily press that unneutral messages were being transmitted to Germany. Allegations were made as to the surreptitious use of special codes and code machines for deceiving the government censors detailed to the plant, and the matter was complicated further by an application to the Department of Commerce for license of a newly installed transmitter. The Sayville station is therefore on the same basis of federal control as that which has governed the installation at Tuckerton, N. J., since Sept. 14, 1914.

At the time of cable service interruption, shortly after the beginning of the war, when the Azores-Emden line direct to Germany was cut by the Allied forces, the Sayville and Tuckerton plants were in communication with German radio stations. These installations offered the only means of communication with Germany that were not subject to British censorship. A dispute as to the ownership of the Tuckerton station made it desirable for the United States to take over that plant for operation until final action by the courts could be secured or until the need for strict neutrality of transmitted matter no longer existed. The Sayville apparatus, however, was left in the hands of its owners for the transmission of commercial messages between the United States and Germany, although the government took the precaution of sending censors to the station and instructed them to scrutinize closely all messages offered for delivery in Germany and Austria. The sending instruments at Sayville were sufficiently powerful to permit satisfactory working with Nauen during the winter season, which is favorable for long-distance wireless, and until a month or so ago no criticisms were offered as to the character of communication maintained. Recently, however, much publicity was given to statements of various interests that the German-owned Sayville station was actually sending to Germany information as to shipments of munitions from the United States. It was claimed that by the use of plain language codes, or by intricate combinations of apparently innocent message numbers, etc., data for the continuance of Germany's submarine warfare were supplied from the United States. Several inventors alleged that the Sayville plant utilized secret installations of their code-sending devices. It was suggested that Prof. J. Zenneck, the widely-known authority on wireless signaling, who has been in the United States for some months aiding the Atlantic Communication Company in defending the patent suits brought against it by the Marconi and National Electric signaling companies, had been detailed by the German government to devise codes and transmission methods which would permit the sending of information as to contraband shipments without discovery by the censors. Finally, the contention was made that Sayville transmitted such messages directly to German submarines lying in wait for transatlantic steamers in the war zone.

Although the older 60-kw. input spark transmitter at Sayville was large enough to send messages direct to Nauen under favorable conditions, it was found that insufficient power was available to allow reliable transmission by daylight during the summer months, when "static" is prevalent. The Atlantic company therefore imported and installed a larger sender, on the continuous-wave principle, which was capable of radiating 100 kw. of sustained waves from the antenna. The aerial wire system was enlarged by the erection of two additional 500-ft. towers. Before the operation of this new plant could be begun it was necessary to secure a license from the Department of Commerce, and some delay was experienced in obtaining this. The Hague convention of 1907 provided against the establishment of wireless stations upon neutral territory by belligerents, and it was ruled by the Department of Commerce that the additions to the Sayville plant constituted the establishment of a new station. This, taken in connection with the complaints as to violations of neutrality by the transmission of coded intelligence, is stated to be the reason for the government's seizure of the station.

Since the beginning of operation by the Navy Department the new sustained-wave transmitter has been put in use, and communication in both directions is effected either in the daytime or at night.

Boston "Tech" to Have Benefit of McKay Millions

Attorney-General Attwill of Massachusetts has sent a notification to the Supreme Judicial Court of that State that no objection will be made on behalf of the commonwealth to the transfer of the excess income of the five-million-dollar Gordon McKay bequest to Harvard University to the Massachusetts Institute of Technology. The fund was bequeathed to Harvard University to maintain a school of arts and sciences to be known as the McKay School of Art, the terms of the will specifying that among the particular subjects of instruction should be mechanics, chemistry, electricity, physics, engineering, manufacturing and commerce. The will also authorized Harvard University to erect buildings for the school, but the trustees of the university came to the conclusion recently that the Institute of Technology is better fitted to carry out the ideas of the donor than is Harvard, and the working agreement between the two institutions of about a year ago paved the way toward a transfer of the fund's benefits to the institute. The trustees of the McKay will have recently asked the Supreme Court for authority to transfer the fund, which will thus be effective at a time when the new buildings of the institute in Cambridge are coming into being. The excess income of the fund since 1909 has amounted to $160,000.

"Electrical Prosperity Week" Campaign

To encourage manufacturers of farm machinery to demonstrate their equipment in action at farm expositions and congresses, the Society for Electrical Development is conducting an active campaign among farm-machinery concerns and in agricultural journals, urging that whenever possible motors be connected to the equipment. Sometimes fire laws prohibit the use of gasoline engines. This is a part of the society's work in the "Electrical Prosperity Week" campaign. To bring to the attention of the public the many applications of electrical energy is one of the main objects which the staff of the society keeps in mind.

To make the week a success from a sales standpoint the staff of the society realizes that individual work and individual sales campaigns must be conducted. Companies will send out salesmen to show housewives how to use electricity in the home. Women's clubs, public schools, department stores and the public are important elements in the campaign. It is expected that the public will do the electrical Christmas shopping during the week instead of during the rush of the holiday, and that "Electrical Prosperity Week" will therefore offer a splendid sales opportunity.

Miscellaneous News Notes

A Floating Water-Power Plant.—A small floating water-power plant has been installed in Carroll Creek at Waynesboro, Pa., by Mr. A. G. Watkins. The inventor hopes to interest capital in the idea and to manufacture such plants on a large scale.

The Tax on Vehicles in Michigan.—Under the new motor-vehicle law in Michigan, which takes effect next January, electric trucks will be taxed on the basis of 50 cents per hp. and 25 cents per 100 lb. of weight. Electric passenger cars will be taxed on the basis of $1 per hp. and 25 cents per 100 lb. of weight.

Tax-Exemption Bill in Alabama.—The House of Representatives of the Alabama Legislature, sitting as a committee of the whole, has sustained provisions of the new revenue bill exempting from taxation for ten years water-power companies, shipbuilding plants, cotton mills and other large industries.

Wisconsin Legislators to Vote by Electricity.—Governor Philipp of Wisconsin has signed a bill authorizing the expenditure of $12,000 for an electrical voting system for the Legislative Assembly chambers at Madison. A Milwaukee inventor, Mr. B. L. Broboff, devised and installed the system with which, it is declared, a complete roll call can be taken in four seconds.

Commissioner Ballard of Cleveland May Resign.—Light and Heat Commissioner F. W. Ballard of Cleveland, Ohio, has suggested that he resign his present position and accept a position as consulting engineer for the city. He said that the municipal plant in Cleveland has been completed and is a success, that it is not necessary for him to keep the position longer but that he is willing to have such a connection that the city may have his services when desired.

A "Twice-as-Many" Week.—In view of the fact that on July 23, 1915, the United Electric Light & Water Company had doubled the number of customers on its lines that it had when it assumed control of the New Britain (Conn.) property, on Jan. 1, 1912, it is proposed to hold a publicity demonstration during the week of Aug. 16 to 21. The company is going to call this week, "Twice-as-Many" Week, make special displays, distribute premiums and prizes, and will otherwise advertise the fact.

Monthly Payment of Bond Interest.—The *Doherty News* publishes part of an address made recently by Henry L. Doherty before Harvard University students, in which the following appeared: "I predict that the tendency will be toward a registered bond with interest payable by check every month. We collect our bills monthly from our customers, and it is absurd for us to expect the man who is both our customer and our bondholder forever to continue to permit us to collect our bills from him once a month, and only pay him what we owe once in six months."

Electric Fans on Main Street Cool Dayton Shoppers.—On twelve ornamental lighting standards on Main Street, Dayton, Ohio, Mr. Thomas F. Kelly, commercial manager of the Dayton Power & Light Company, has recently had installed an equal number of 16-in. oscillating fans to cool pedestrians, shoppers and the market folk who have stands along the section from Third to Fifth Street. The fans were operated for the first time on a recent sizzling-hot Saturday, and the innovation occasioned many compliments from the grateful public and from the newspapers of the city. Each fan bore a card which read: "Keep Cool. The Dayton Fan & Motor Company.—Made-in-Dayton Electric Fans. Operated by the Dayton Power & Light Company."

Petrograd Seeks Light on American Street-Illumination Methods.—Count J. Tolstoy, Mayor of the city of Petrograd, Russia, has written to the City Council of Los Angeles, Cal., asking for a comprehensive report on the latter's street-lighting system. Petrograd, he explains, is about to proceed with the rearrangement of the lighting of its streets, and he asks for a detailed account of the experience of Los Angeles in the field of civic illumination. A list of questions was inclosed with the inquiry, together with a request for "illustrations of various articles of outfit of the lighting plant of your town, as, for instance, pillars, pilons, transformator and distributor cabins, etc." City Electrician Manahan of Los Angeles is now at work on a complete report which will be sent to the Mayor of Petrograd with the compliments of the Los Angeles Council.

Apprenticeship Course Offered by Baltimore Central Station.—In line with the practice of some large manufacturing concerns, the Consolidated Gas, Electric Light & Power Company, Baltimore, Md., has recently established an apprenticeship course. Graduates of universities and colleges, and also graduates of some secondary schools, are eligible. The course consists of at least two months' training in each of the following departments: Test, installation, construction, drafting, wiring, operating, distribution and commercial. The college apprentices will be paid somewhat higher than the secondary-school graduates. Apprentices who show exceptional ability in any department will be given permanent positions therein when opportunity affords. In the future it is intended to allow a limited number of employees already with the organization to take advantage of the apprenticeship course. Mr. A. S. Loizeaux, electrical engineer, is supervising the courses.

A Municipally Lighted Tennis Court in Louisville Park.—An electrically illuminated tennis court has been provided by the Park Commissioners of Louisville, Ky., as an experiment to determine whether it will be feasible to light by artificial means a score or more of the courts in the local public parks for the use of persons who are unable to play during the daytime. This Louisville court is one of the first ever lighted for night tennis by municipal authorities. Four 1000-watt tungsten lamps are mounted at 28-ft. intervals, the two inside lamps being fixed at a distance of 14 ft. each way from the net. The lamps are suspended from a single line stretched between two poles which are set back of the backstop nettings. The lamps hang in a row 30 ft. above the surface of the court. Skirt reflectors concentrate the light on the court and at the same time prevent glare which would interfere with vision. The total cost of the material for lighting the court was $135.

Associations and Societies

Milwaukee Electrical League.—At the recent election held by the Milwaukee (Wis.) Electrical League Mr. John C. Schmidtbauer was chosen president, Mr. Conrad F. Boos vice-president, Mr. Phil Polachek second vice-president, Mr. John C. Milne treasurer, Mr. H. C. Pond secretary, and Mr. Oscar Werwath assistant secretary.

Picnic of Chicago Electric Club-Jovian League.—About 375 members of the Electric Club-Jovian League of Chicago and their families enjoyed an outing at Ravinia Park, near Chicago, Aug. 5. A large number of prizes contributed by local electrical manufacturers and supply houses were distributed to contestants in the athletic and other events. The proceeds of the day were voted to the Eastland disaster sufferers.

Cincinnati Central-Station Employees Hear Address on "Opportunity."—The joint meeting last week of the Cincinnati Section of the National Electric Light Association and the Mutual Benefit Association of the Union Gas & Electric Company, held in the company's auditorium, was addressed by Prof. A. M. Wilson of the University of Cincinnati on "Opportunity." President W. W. Freeman of the Union company presided and spoke along a similar line of thought, emphasizing the wide opportunities which lie in public utility service for the man who is competent and conscientious.

Radio Engineers at San Francisco.—Joint meetings of the Institute of Radio Engineers and the American Institute of Electrical Engineers will be held Sept. 16 and 17 at the Native Sons of the Golden West Hall, San Francisco. On Thursday afternoon Prof. Harris J. Ryan will read the results of investigations on the "Sustained Radio Frequency High-Voltage Discharge," by Mr. Roland G. Marx and himself, taking up the flame and brush types of discharge obtained from conductors when a powerful arc generator is used to apply potentials up to 50,000 volts at frequencies as high as 200,000 cycles per second. On Friday Mr. Robert H. Marriott will read a paper on "Radio Development in the United States," giving special attention to Pacific Coast conditions.

Public Service Commission News

Idaho Commision

The differences between the Marsh Mining Company of Cœur d'Alene and the Washington Water Power Company, which led to a complaint by the mining company that rates of the power company were unfair and in excess of what they should be, have been settled by the companies. The commission ordered the complaint dismissed.

An order has been issued by the commission suspending the tariff of the Great Shoshone & Twin Falls Water Power Company, which provided for increased rates for electrical energy for heating purposes. The commission has notified all cities and towns that they can intervene, and some of them will do so. The company says in its application for an increase that heating by electrical energy is not practicable but that it has surplus energy and uses it for that purpose at a rate that has been found to be too low.

Pennsylvania Commission

The commission has rendered an opinion through Commissioner Monoghan interpreting the public utilities law relating to the duty of one telephone company to connect with the lines of another telephone company. The commission decided that where two localities are served by one continuous line or by connections between the lines of two telephone companies another telephone company has no right to demand connection in the absence of proof that the service rendered is inadequate and insufficient. This decision was reached on the complaint of the Blairsville Telephone Company against the Johnstown and the Windber Telephone Companies.

As some doubt has arisen as to the proper procedure to be followed under General Order No. 11, the commission has issued the following ruling:

"(1) Where the public service companies have entered into an agreement providing for and prescribing the particular point or points of crossing and also the way and manner of the construction thereof, no notice is required to be served upon the company whose facilities are crossed, but notice of the proposed crossing must first be given in writing to the commission, together with a certified copy of the agreement, and immediately after the crossing or crossings have been constructed a certificate, duly verified, setting forth that the same have been constructed in accordance with the terms of the agreement, shall also be filed with the commission;

"(2) Where the public service companies have executed general agreements which do not specify the particular point or points of crossing, but provide for the way and manner of the construction of all crossings, notices as required by General Order No. 11 must be served upon the company whose facilities are crossed and copy of said notices, with proof of service thereof, filed with the commission, together with certified copy of the general agreement, unless same has been heretofore filed;

"(3) Where no agreement exists between the public service companies with respect to crossings, notices must be served and filed as required by General Order No. 11."

Missouri Commission

The commission has issued an order directing the Fort Scott & Nevada Light, Water & Power Company to reduce its electric rates in Nevada, Mo., about 17 per cent. The company was directed to reduce its rates from 12½ cents to 11 cents per kw.-hr. for the first twenty hours, 9 cents for the next twenty hours and 6 cents for each additional twenty hours.

Indiana Commission

A decision fixing rates for the Indianapolis Light & Heat Company and the Merchants' Heat & Light Company has been issued. The schedules are to take effect on Sept. 1, 1915. The maximum rate is to be 7 cents per kw.-hr., or 6.5 cents net, including lamp renewals.

An agreement has been approved by the commission, through Commissioner Charles A. Edwards, by which a temporary schedule of rates for consumers of the Huntington Light & Fuel Company will be in effect for a year. Meanwhile the commission is making an appraisal of the property.

It is reported that the commission has decided to take no further hand in a controversy between Indianapolis telephone companies over the contemplated construction of a new exchange for part of the city by the Central Union Telephone Company. Efforts to effect a merger of this company with the Indianapolis Telephone Company have failed so far, but commissioners are still outspoken in their demand that a consolidation be completed. The commission has no power to force a merger. It has warned both companies against further duplication of investment, however, asserting that it will not allow for such duplication in subsequent rate-making.

New York Commissions

The joint petition of the Cataract Power & Conduit Company and the Buffalo General Electric Company for modification of the previous order of the commission in the matter of the complaint of Mayor Fuhrmann of Buffalo is before the Second District commission. The recent opinion of the commission in this case, written by Commissioner Carr, said that the orders of the commission issued on April 2, 1913, fixed reductions of 28 per cent in the Cataract company rates and approximately 25 per cent in the Buffalo company rates. The Buffalo company obtained a modification of the order on June 18, 1913. No amendment has been made of the Cataract company order.

In the Cataract case the order providing for a 28 per cent reduction in rates made an exception of the International Railway Company, the largest customer, which was being supplied with energy under a contract that does not expire until 1932. The commission held that, inasmuch as the contract had many years to run and the railway company was not a party to the proceeding and had not complained of its rates, it was doubtful if the commission had any right to interfere with the rates, the question of discrimination not being raised. Subsequently the Railway company began a proceeding to review the order for the purpose of obtaining a determination that it was entitled to receive the benefit of the reduction. The Cataract company also began a proceeding to review the order and both proceedings were pending when the Cataract company and the Buffalo company presented their petitions to the commission in April, 1915. The Cataract company asked for a modification so as to make the reduction in its rates 19 per cent, applicable to all of its customers, including the railway company.

The Buffalo company asked that the order of April 2, 1913, be put into effect and the order of June 18, 1913, modified to that extent. These requests were made contingent upon the consent of the commission to the proposed merger of the companies, in which event the revised rates would go into effect immediately thereafter and all litigation over rates would be dismissed. The Mayor and Common Council of Buffalo have approved the proposed modification of rates and the merger of companies.

Under the amended order which the commission made, the Buffalo company has collected money from customers which now aggregates a large sum and will be refunded to them if matters are brought to a conclusion as proposed. The same statement is true of the Cataract company, but the amount which is to be returned to customers is far in excess of the amount to be received by the Buffalo company customers. There can be no objection on the part of any one to the application of the Buffalo company to put in force the order of April 2, 1913. There would seem to be no valid objection to the request of the Cataract company in view of the fact that the railway company has become a party to the proceedings and has joined in the application of the Cataract company for a modification of the order of April 2, 1913, fixing the Cataract rates so as to provide that the reduction should be 19 per cent instead of 28 per cent.

A 20 per cent reduction in rates for all Cataract company customers produces substantially the same reduction in operating revenue as the 28 per cent reduction to all customers excepting the Railway company. There would seem to be no good reason why the Railway company, the largest customer, should pay the Cataract company more for service

than other customers. Any question which may have existed at the time the order of April 2, 1913, was made as to the right of the commission to make the rate applicable to the Railway company is disposed of now that it comes before the commission and asks that it be given the benefit of the reduction notwithstnding the provision of its contract with the Cataract company. Further study by the commission has satisfied it that the rates scheduled could be improved considerably and at the same time accomplish substantially the same reduction in the revenue which was contemplated when the order of April, 1913, was issued. Certain discriminations are bound to arise in existing rates due to the "step rate." It is believed that the Cataract company can establish very properly a schedule much better than the one which would result from a 19 per cent reduction in the rates in existence when the order of April 2, 1913, was made, and one that would eliminate the possibility of discrimination. It would also provide for certain reductions which the company has been requested to make by a great many users of energy for motor service who would be affected favorably.

It is the belief of the commission that the Cataract company should take necessary steps at once to put in force the simplified schedule which will enable it to deal with all its customers alike and at the same time result in a reduction of 19 per cent in the revenues in Buffalo.

District of Columbia Commission

A hearing will be held by the commission on Aug. 25 to consider the following matters: The proper measurement of energy used by the Potomac Electric Power Company and the Washington Railway & Electric Company and other utilities which receive energy from these companies, and the installation of the instruments necessary to make such measurements; the proper basis for the determination of the proportion of all charges for the production, transmission and distribution of energy to be paid by the Washington company and the Potomac company, wherever joint ownership or operation is claimed; in all sales of energy by the Washington company and the Potomac company to other utilities, the basing of these sales on the same unit of measure, a unit of energy, free from charges for the use of other facilities; in the payments by the Washington company and the Potomac company of all charges for energy production, transmission and distribution, whether there is unjust or unreasonable discrimination against either company; in the sale of energy by the Washington company or the Potomac company to other utilities, whether there is unjust or unreasonable discrimination; the filing with the commission of the rates at which energy is sold by the Washington company and the Potomac company to other utilities.

Kansas Commission

In its second biennial report, covering the period ended Nov. 30, 1914, the commission says that it regards the existing public utilities law and supplementary legislation as at least reasonably comprehensive and efficient, that some amendments are desirable and even necessary, but that, in the opinion of the commissioners, no attempt should be made to rewrite, recast and re-enact the law, considered as a system. Much better results can be attained by retention of the law in substantially its present form and the enactment of amendments demanded by necessity and experience.

The engineering department, in making investigations as to the value and necessity of improvements to be bonded and as to the assets and liabilities of the companies making applications, has been handicapped by the smallness of the force. It is hoped that eventually a complete record of the physical property will be established for all utility companies issuing stock and bonds by authority of the commission.

The engineering department has been called into consultation by a number of cities in regard to various problems in connection with water, gas and electric utilities. The problems have had to do with construction, operation and efficiency. In one case, after thorough examination, an informal opinion was rendered as to what was considered a reasonable price for one of the larger private water companies.

Personal

Mr. G. A. Blucher has been appointed resident engineer for the Texas Power & Light Company at Bonham, Tex.

Mr. J. B. Bridges, vice-president of the Gray's Harbor Railway & Light Company of Aberdeen, Wash., has been appointed general manager, succeeding Mr. P. A. Bertran.

Mr. A. W. Rogers of Beverly, Mass., has resigned as treasurer of the Newburyport (Mass.) Gas & Electric Company.

Mr. R. F. Sikes has been appointed manager for the Texas Power & Light Company at Ennis, Tex., succeeding Mr. M. P. Ruthenberg.

Mr. O. E. Hubbard, formerly of Nacogdoches, Tex., has been appointed general manager of the Clarksville (Tex.) Ice, Light & Power Company.

Mr. Scott Haven has been appointed superintendent of the Central Illinois Utilities Company at Saybrook, Ill., succeeding Mr. O. C. Van Cleave.

Mr. Philip Cabot of Boston has been elected president of the Newburyport Gas & Electric Company of Newburyport, Mass., succeeding Mr. Sidney W. Winslow.

Mr. O. C. Van Cleave has been appointed local superintendent for the Central Illinois Utilities Company at Paxton, Ill. Mr. Van Cleave was formerly superintendent at Saybrook.

Mr. Charles T. Doerr, purchasing agent of the Birmingham Railway, Light & Power Company, Birmingham, Ala., has returned to his office after a successful operation for appendicitis.

Mr. A. M. Evans has been elected president of the Home Electric Light Company of Lonaconing, Md., to succeed Mr. Isaac Bradburn. Mr. Evans was formerly secretary of the company.

Mr. Charles H. Wilson, formerly general superintendent of the long-distance lines department of the American Telephone & Telegraph Company, has been appointed general manager of the department.

Mr. Joseph Bradley Murray has been appointed acting treasurer of the Edison Electric Illuminating Company of Brooklyn, N. Y. Mr. Murray is a son of Mr. Thomas E. Murray, vice-president of the New York Edison Company and of the United Electric Light & Power Company of New York City.

Mr. W. R. Herstein is chairman of the committee which will conduct the automobile parade planned to signalize the Memphis (Tenn.) convention of the Cotton States Merchants' Association, Aug. 17 to 19. It is expected that there will be 1000 automobiles in the parade, many of the delegates having announced that they will motor in their own cars to Memphis.

Mr. Edwin G. Hatch, consulting engineer, New York City, has been retained by the Victoria Falls & Transvaal Power Company of London, England, to handle the testing and inspection of a 9000-kva. transformer which is now under construction at the Westinghouse works at East Pittsburgh, Pa. Five similar transformers were shipped to the company's plant in South Africa in 1912.

Mr. John Osterberg, chief electrical engineer of the Swedish Steam Users' Association, Stockholm, Sweden, is visiting the United States on a trip of inspection to study safety precautions and methods in use about electrical machinery and power systems in this country. Mr. Osterberg has just returned from the San Francisco Exposition and plans to sail for Sweden on Saturday, Aug. 15.

Mr. Irving M. Frost, upon his resignation as general manager of the Rutland (Vt.) Railway, Light & Power Company, was presented with a handsome gold watch and chain by his former associates and subordinates, employees of the Rutland company. A happy presentation speech was made by Mr. W. P. Jones in tendering the gift. Mr. Frost's new enterprise, the Hortonia Power Company, will have offices in the Gryphon Building, Rutland.

Mr. George H. Hudson, formerly in charge of the Boston branch of the American Locomotive Company, has succeeded Mr. Day Baker as New England manager of the General Vehicle Company, with headquarters at Boston. Mr. Hudson is a native of Gloucester, Mass., and is well known in

Boston business circles. For the last two years he has been in charge of the gasoline-truck branch of the General Vehicle Company's New England sales office.

Mr. Henry O. Loebell has been appointed engineer in charge of the new electrical-heating department of the H. L. Doherty organization, the headquarters of which will be at Toledo, Ohio, where Mr. Loebell recently supervised the installation of the initial equipment for the 15,000-kw. heating load of the Willys-Overland Automobile Company. The work of the new department will consist in the study and development of new opportunities for industrial electric-heating business.

Mr. Ward Barnum, who, as recently announced in these columns, has resigned his position as electrical engineer for the Louisville & Nashville Railroad to become senior electrical engineer for the Interstate Commerce Commission, division of valuation, Southern District, has been assigned to valuation work on the Big Four Railroad for the present, with temporary headquarters at Indianapolis, Ind. Mr. Barnum's new permanent address is 38 Municipal Building, Chattanooga, Tenn.

Mr. Adrian Tobias has been appointed superintendent of meters for the Republic Railway & Light Company, which operates twenty-seven electric railway and lighting properties in the vicinity of Youngstown, Ohio. For the last four years Mr. Tobias has been the meter specialist for the Westinghouse Electric & Manufacturing Company, covering all the company's district offices in the United States. Prior to his connection with the Westinghouse company he was for a number of years sales manager of the Duncan Electric & Manufacturing Company, Lafayette, Ind. At the time of the late convention of the Ohio Electric Light Association at Cedar Point Mr. Tobias was appointed a member of the meter committee of the association.

Mr. A. J. Edgell of the Society for Electrical Development, Inc., was chosen president of the International Association of Display Men at New York, Aug. 5, during the association's convention at the Hotel Waldorf, which was attended by more than 900 delegates. Mr. Edgell has charge of the display service bureau of the Electrical Development Society and is widely recognized as an expert in store-front and window betterment. Coincident with Mr. Edgell's elevation to the presidency of the association came the announcement that he had won first prize in the "idea letter contest" of the Rice Leaders of the World Association. This prize was competed for by several thousand business men, advertising experts and others, and it carried with it an award of $1,000 for the best suggestion for a letter.

Robert F. Pack, vice-president and general manager of the Minneapolis (Minn.) General Electric Company, is one of the leaders of a movement in Minneapolis to prevent disintegration of American citizenship by conflicts of race and opinion growing out of the European war. Representatives of various nationalities have formed a committee which called a general meeting in the interests of harmony and good feeling, and the suggestion has been met enthusiastically by the press and by citizens in all walks of life. A section of the resolutions adopted read as follows: "That we will strive by word and deed to foster and maintain a spirit of friendship between our neighbors and fellow citizens regardless of their origin, believing that on so doing a feeling of mutual helpfulness will be engendered which will bring together in closer sympathy and better understanding the various peoples constituting our citizenship." The movement will be promoted by a committee of which Mr. Pack is a member.

Mr. H. G. Thompson, the newly appointed general sales manager of the Edison Storage Battery Company, was until recently manager of the railroad department of the company, of which he is also a vice-president. In his new work Mr. Thompson will have charge of all sales, including the railway, lighting and commercial departments. Born in Massachusetts in 1875, he entered the employ of the Pullman Company at the age of twenty-one, two years later being made foreman of electricians. In 1905 he entered the employ of the Pennsylvania Railroad in charge of car lighting at Jersey City. He later was made electrical superintendent of the Safety Car Heating & Lighting Company and was also manager of the railway department of the Westinghouse Storage Battery. In 1910 he became associated with the Edison Storage Battery Company.

Mr. Robert Montgomery, the president of the Louisville (Ky.) Jovian League, is the commercial manager of the Louisville Gas & Electric Company and one of the most successful central-station new-business men in the country.

ROBERT MONTGOMERY

Born at Salem, Ind., thirty-three years ago, Mr. Montgomery spent his boyhood at Jeffersonville, Ind., just across the Ohio River from Louisville, and secured his first electrical experience in the local car-building shops. Later he was "handy boy" for the old Jeffersonville Lighting Company, and by the time he had reached the age of twenty-one was engineer in charge of the power plant. Two years later he worked as construction foreman on erection work for the Cincinnati office of the General Electric Company, installing plants at Nashville, Tenn., and Hopkinsville, Ky. Mr. Montgomery's services in rehabilitating the latter plant when it suffered badly from local floods led to his appointment as manager at Hopkinsville in 1907. The next year, however, when a fire destroyed the nearby plant at Lebanon, Tenn., Mr. Montgomery was summoned to rebuild it, and then remained as manager of the property until 1909. Next he joined the motor-service sales staff of the Chicago, Lake Shore & South Bend Railway, which furnished central-station service along its line. Leaving Indiana, he took charge of the Fort Worth (Tex.) Power & Light Company's contract department, but on Feb. 1, 1914, was called to Louisville as manager of the sales department of the then newly organized merger company. Since his appointment Mr. Montgomery's department has added 6000 customers to the lines of the Louisville company, and the number of old residences wired in a single year has totaled 4000.

Prof. Alexander Gray of McGill University, Montreal, has been appointed professor of electrical engineering in Sibley College, Cornell University. Professor Gray will also be the head of the electrical department, filling the vacancy made by the resignation of Prof. H. H. Norris. He will take up his new duties at Cornell in September. Professor Gray was born in Edinburgh, Scotland, of a well-known family of engineers. When fifteen years of age he was apprenticed and worked for seven years at the lathe, bench and drafting board. During this time he attended evening classes and, later, the engineering classes of Edinburgh University, from which he graduated in civil and mechanical engineering in 1903. At that time he was awarded a Whitworth scholarship, which enabled him to spend two years at McGill University, Montreal, where he studied electrical engineering. After graduation from McGill University, Professor Gray joined the engineering staff of the Bullock Electric Company of Norwood, Ohio, and later the staff of the Allis-Chalmers Company of Milwaukee, Wis., with which companies he remained for five years. During this time he gained wide experience in the design, construction and operation of all types of electrical machinery. In 1910 he accepted an appointment as assistant professor at McGill University, which position he has held for the last five years. Professor Gray has been granted a considerable number of patents for electrical apparatus. He has also contributed largely

ALEXANDER GRAY

to the literature of his subject, and his two recent books, namely, "Electrical Machine Design" and "Principles and Practice of Electrical Engineering," have been widely adopted as university texts and are favorably known to the profession.

Mr. D. C. Green, who was recently appointed manager of the Salt Lake City division of the Utah Power & Light Company, has been in public utility work for the last seven years since his graduation from the electrical-engineering school of Purdue University in 1908. Prior to entering Purdue in 1905, Mr. Green was foreman of the testing department of the Allis-Chalmers Company at Cincinnati, Ohio. After graduating he became associated with the Pacific Coast properties of H. M. Byllesby & Company, being first appointed manager of the commercial department of the San Diego Gas & Electric Company at San Diego, Cal. Following this he went to Albany, Ore., as manager of the Albany division of the Oregon Power Company. Later he was given the management of the Coos Bay division of this company's property, and was then appointed manager of the Everett Gas Company, from which position he came to Salt Lake City. The Salt Lake division of the Utah Power & Light Company embraces the territory of Salt Lake City, its suburbs, Midvale, Sandy, Riverton, Draper, Sugar House and other districts in the vicinity of the Utah capital.

Mr. Elmer A. Sperry, the president-elect of the New York Electrical Society, has for many years been a prolific inventor of mechanical and electrical devices, the most notable among the number being his early system of electric lighting, the gyroscopic compass, and the gyroscopic stabilizing device for aeroplanes. Born at Cortland, N. Y., Oct. 12, 1860, he early manifested a marked mechanical aptitude. After receiving instruction at Cornell University, Mr. Sperry undertook a course of investigation of the principles of the dynamo, and set out to design electromagnetic machinery of improved efficiency. The Sperry system of electric lighting was first successfully exhibited at Cortland on Christmas Eve, 1880. Shortly afterward he instituted and constructed the largest electric-lighting station in Chicago, he himself attending to the business arrangements as well as to details of the engineering of the plant and underground distribution system. During the same period he matured plans for a system for the transmission of power and perfected inventions having to do with electric-railway brakes, automatic switches and appliances, motors and other electrical machinery. While in Chicago Mr. Sperry conceived the idea of and installed the 45,000-cp. lamp on the 403-ft. Board of Trade tower, which was an early-day wonder of the Western metropolis. Incidentally, a new form of lightning arrester was devised in connection with the atmospheric electrical discharges down this tower. An automatic gas engine, a motor-driven mining machine, an automatic ground switch and a system of messenger call boxes were among Mr. Sperry's other inventions of the period. Mr. Sperry's recent work with the gyroscope has attracted the widest scientific and popular interest and has resulted in two extremely important inventions—the Sperry gyroscopic compass (a device for mariners, the directive power of which is independent of the earth's magnetic field and many times stronger than the ordinary magnetic compass) and the gyroscopic stabilizer for aeroplanes, for which Mr. Sperry last year received the 50,000-franc prize offered by the French government. Mr. Sperry is a charter member of the American Institute of Electrical Engineers and was chairman of the committee of call for the first meeting of the National Electric Light Association. He is the vice-president of the American Society of Aeronautical Engineers and was last week elected by that society to be one of its two representatives on the new Naval Advisory Board of inventors.

E. A. SPERRY

Corporate and Financial

Buffalo (N. Y.) General Electric Company.—An issue of $1,250,000 first refunding mortgage 5 per cent gold bonds, due on April 1, 1939, is offered at 98½ and interest. The sale reimburses the treasury for extensions and improvements. It is proposed also to issue $1,298,000 bonds for the acquisition of the Cataract Power & Conduit Company stock. The issue has been approved by the Public Service Commission, which authorized the company recently to acquire the entire stock of the Cataract company, and has approved the merger of the two properties. The company is now acquiring this stock under existing contracts with practically all stockholders. Since 1896 the Cataract company has purchased energy from the Niagara Falls Power Company and sold it to larger consumers in Buffalo, including the Buffalo General Electric Company, electric railway companies and manufacturers, and has also provided the small amount of light in territory not reached by the lines of the Buffalo company. The proposed consolidated company will unite the wholesale and retail distributing systems and will eliminate considerable operating expense. It will obtain its energy from the Niagara Falls Power Company under a contract already negotiated, which will be executed contemporaneously with the transfer to the Buffalo General Electric Company of the Cataract company stock now owned by the Niagara Falls Power Company. The combined earnings of the two companies for the twelve months ended June 30, 1915, after eliminating intercompany business and deducting the reduction in Cataract company rates ordered by the Public Service Commission, follow:

Gross revenue	$2,675,353
	1,770,916
Net applicable to interest	$904,437
Interest on present debt	352,950
Balance	$551,487

Commonwealth Power, Railway & Light Company, Jackson, Mich.—Herewith are shown the comparative statements of earnings for the years ended June 30, 1915 and 1914:

	1915	1914
Earnings on stocks owned by this company in subsidiary companies	$2,382,175	$2,463,861
Interest and other earnings	500,517	517,823
Gross earnings	$2,882,692	$2,981,684
Expenses and taxes	$104,316	$114,508
Interest charges	602,700	659,842
Total deductions	$707,016	$774,350
Net income available for dividends, replacements and depreciation	$2,175,676	$2,207,334
Dividends on preferred stock	960,000	960,000
Balance	$1,215,676	$1,247,334

Consolidated Gas, Electric Light & Power Company of Baltimore, Md.—During the second month of the company's campaign for new stockholders among customers, which ended on Aug. 10, a total of sixty-nine new names were added to the stockholders' lists. For the third month, or until Sept. 10, the price will remain the same as in the second month, namely, $107.50 per share. During the first month of the campaign 741 customers subscribed for stock at 106.5. Thus in two months 810 customers have joined the ranks of stockholders.

Long Island Lighting Company, New York, N. Y.—The New York Public Service Commission, Second District, has authorized the absorption of the Babylon Electric Light Company. The Long Island Lighting Company is permitted to issue $175,000 of 5 per cent twenty-five-year first mortgage gold bonds at not less than 87½, to net $153,125, and $125,000 capital stock at par. The proceeds, $278,125, are to be used to acquire all the property, rights and assets, including franchises and subject to liabilities of the Babylon company, which will thereupon dissolve and cancel its outstanding stock, $75,000.

Newburyport (Mass.) Gas & Electric Company.—The management of the company has passed into the hands of Mr. Philip Cabot of Boston, Mass., as president, and Mr. Lester L. Flint of Belmont, Mass., as treasurer. The company has 2300 gas customers and 500 users of electricity. The new management plans to develop the electrical market intensively. No immediate enlargement of plant is antici-

pated, but a rapid expansion of electrical service is in prospect.

Northern States Power Company, Chicago, Ill.—In connection with its campaign for selling stock to residents of the territory it serves, the company is planning to offer to customers the privilege of subscribing for its 7 per cent preferred stock on partial payments. A customer may purchase not less than one or more than ten shares at the rate of $5 per share a month either directly from the local utility company or through a bank. Initial subscriptions will be received at the price of $90 per share. Since the preferred stock was offered on a cash basis a short time ago, approximately 700 shares have been taken by citizens of cities in which the subsidiaries of the company operate.

Orange County Public Service Company.—A Philadelphia syndicate headed by Mr. Edward E. Mandeville is forming a merger of gas, power and light companies in New York, according to papers filed with the Public Service Commission, Second District. The company will be known as the Orange County Public Service Company, and will control the Orange County Company, the Cuddebackville Company and the Monticello Light & Power Company, covering the cities of Middletown, Monticello and Port Jervis, as well as the towns of Cuddebackville, Otisville and Howells, with a population of nearly 40,000. The syndicate controls the Port Jervis Light & Power Company and the Port Jervis Traction Company.

San Joaquin Light & Power Corporation, Fresno, Cal.—The California Railroad Commission has issued a supplemental order authorizing the corporation to pledge as collateral $205,000 first and refunding mortgage forty-year Series C 6 per cent bonds for an issue of $153,750 of promissory two-year 8 per cent notes.

Shawinigan Water & Power Company, Shawinigan Falls, Quebec, Canada.—In view of the recent offering of stock the management has sent to shareholders special information, in part as follows: "At the inception of the development it was expected that the following elements would contribute to success: First, the utilization of water and electric power immediately at Shawinigan Falls and the development of an industrial community; second, the transmission of electric power to the larger cities within reasonable distance, including Montreal, Three Rivers and Quebec, and, third, the general distribution of electrical energy throughout the zone of operation, including the larger centers. During ten years of operation the first element enumerated was covered by establishing at Shawinigan Falls the following plants: Northern Aluminum Company, manufacturing aluminum in various forms, the initial operation of which utilized 2000 hp. and employed 75 people, while to-day it uses 45,000 hp. and employs 545 people; the Belgo-Canadian Pulp & Paper Company, which at the outset used 6000 hp. and employed 180 people, and to-day uses 14,000 hp. and employs 750 people, and the Canada Carbide Company, which at first used 1000 hp. and employed 40 people, and now uses 20,000 hp. and employs 320 people. The result has been the upbuilding of a substantial community with a population of 7100. The second element of the undertaking was inaugurated by the building of transmission lines, first to Montreal and later to Three Rivers, Thetford Mines, Sorel, etc., and as the result of recent negotiations your company acquired control of the Dorchester Company, Quebec, and will shortly complete a transmission system between that point and Shawinigan Falls. This will complete the transmission of energy to all of the larger cities originally contemplated. Year by year your company has carried out the third element in its development by including within the scope of its operations practically all of the smaller cities and towns in the Province of Quebec, between Montreal to the west, Quebec to the east, and 50 miles to the south of the St. Lawrence River at Thetford and Windsor Mills. The development work gives your company one of the most complete systems of electric transmission on this continent, including over 700 miles of lines, involving the distribution of over 160,000 hp., and covering the larger part of the industrial section of eastern Canada. Your company depends on no one class of user. Each year the demand upon your company has increased. At no previous time has the future been so well assured. Apart from the ordinary development of industrial Canada, the particular section in which your company operates has been peculiarly susceptible to growth, resulting from the utilization of natural resources. The great power resources available and the policy your company has pursued in selling energy at prices which would compete successfully with all other districts have resulted in bringing into the Province of Quebec a large number of enterprises. Your company has always had the benefit of successful and conservative financing, which has enabled it to acquire large interests in companies contributory to its success, such as the Montreal Light, Heat & Power Company, the Cedars Rapids Manufacturing & Power Company, the North Shore Power Company and other companies, the potential value of which has increased each year, thereby adding to indirect income. With the prospect of a large increase in available power as a result of the plans for storage of water on the St. Maurice River, and with its magnificent distribution system, the management is justified in stating that at no distant date your company will be in a position to consider the increase of the common-stock dividend."

Washington (D. C.) Railway & Electric Company.—The report of Mr. Clarence P. King, the president, showed that gross earnings for the six months ended June 30, 1915, were $2,601,738, as compared with $2,527,747 for the same period last year. Net earnings for the first six months of 1915 were $1,103,942, an increase of $860 over the same period last year.

Manufacturing and Industrial

The Metals Coating Company of America, 122 South Michigan Avenue, Chicago, has opened an office at 100 Summer Street, Boston, Mass., which will be in charge of Mr. Herbert Jacques, Jr.

The Qual-Ser Electric Company, Cleveland, Ohio, has recently opened an electric supply store at 7706 Lake Avenue in that city and will handle a general line of electrical goods, specializing in lamps and lighting accessories.

The Elwell Parker Electric Company, Cleveland, Ohio, has been granted a permit to build a four-story factory building costing $40,000 at 4223 St. Clair Avenue. George S. Rider & Company, Century Building, Cleveland, are the architects.

The Western Electro-Mechanical Company, Oakland, Cal., has recently been taken over by Mr. W. J. Foster, who has assumed the position of Mr. O. A. Meitzker, the former manager. Mr. Meitzker has been detained in Europe on account of the war.

Holladay, Negstad & Company.—Mr. Lewis Littlepage Holladay announces that henceforth he will be associated in his practice of consulting engineering, in the field of power plants, utilities and industries, with Mr. Henry Negstad, under the corporate name of Holladay, Negstad & Company, 109 North Dearborn Street, Chicago.

The Wolfsberger Electrical Company, 517 South Main Street, Akron, Ohio, has recently been formed and is engaged in the electrical contracting and supply business. Mr. W. R. Wolfsberger is president and treasurer, Mr. Frank Simpson vice-president, and Mr. F. M. Peck secretary and general manager.

The H. W. Johns-Manville Company, New York, has appointed Mr. F. H. M. Riley, formerly illuminating engineer for the Kansas City (Mo.) Electric Light Company, as the manager of the electrical department of its branch office at Kansas City. Mr. Riley succeeds Mr. W. F. Trader, who has been transferred to the Johns-Manville district office at St. Louis, Mo.

The New York Electric Lamp Company, 38 Park Row, New York, which has recently been incorporated, is engaged in the sale of tungsten and nitrogen-filled lamps imported from Holland and carbon lamps manufactured in this country. The officers of the company are Mr. E. W. Boyce, president, formerly with the New York Incandescent Lamp Company; Mr. H. E. Hoyt, vice-president, and Miss F. M. Ekstrom, secretary and treasurer.

Triumph Electric Company Sees Bright Business Skies Ahead.—The Triumph Electric Company, Cincinnati, Ohio, manufacturer of generators and motors, reports that the outlook for future business is exceptionally bright. The business of the company for June and July was unusually good, that for the latter month exceeding the business for any other month during the last year.

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has appointed Mr. W. P. Cochran, formerly branch manager for the company at Baltimore, as assistant district manager of the Philadelphia territory, which includes Baltimore. Mr. Cochran's headquarters will be in Philadelphia. Mr. M. H. Jones, assistant to manager, will have charge of the Baltimore branch office.

Allis-Chalmers Company Business Improving.—It is reported that the Allis-Chalmers Manufacturing Company, Milwaukee, Wis., is receiving domestic orders in good volume at the present time. Renewed activity is being especially noted, it is said, in the pumping-machinery, cement-engine and steam-turbine departments. An improvement is also being shown in the electrical, mining and milling machinery business of the company.

Engineer Added to Advertising Agency's Staff.—The Russel M. Seeds Company of Indianapolis, Ind., has added to its organization the services of a consulting industrial engineer, Mr. Russell N. Edwards. Mr. Edwards is a graduate of Purdue, with experience in mechanical and electrical engineering, and has been highly successful in the comparatively new science of efficiency engineering. A number of years spent with the Arnold Company of Chicago on the design and construction of public utility and industrial projects, together with his more recent employment with the Central Illinois Public Service Company in Illinois, has equipped him for handling and discussing engineering problems.

Busy at Pittsfield Factory of General Electric Company.—Business at the Pittsfield (Mass.) factory of the General Electric Company has increased 125 per cent since May 1, compared with the corresponding period of 1914, according to Manager C. C. Chesney. In a statement issued early this week Mr. Chesney said that the transformer business is particularly flourishing at present and that, in addition to important Russian orders, the factory is now working on a new order from Spain. A large order from China is expected within a week. The lull in business at the plant caused by an off season in fan-motor orders is gradually being counterbalanced by work in other departments.

Small-Motor Drive for Scottish Woolen Manufacturers.—Small motors are being installed in a number of the woolen mills in Scotland, according to Consul Rufus Fleming, stationed at Edinburgh. A typical installation recently completed is that in an important Galashiels mill, and consists of thirteen motors, ranging in rating from 5 hp. to 25 hp. and having a total rating of 165 hp. It is said that a number of manufacturers now using steam drive are contemplating the adoption of motors. A central-station company in Mr. Fleming's district has issued a statement of the rating in horsepower of motors usually employed in the ordinary trades and industries. The consul also writes that there is a demand for motors operating domestic appliances, such as shoe cleaners, knife cleaners, coffee grinders, sewing machines, washing machines, vacuum cleaners, etc.

Larger Production of Platinum.—According to statistics collected for the United States Geological Survey by Mr. J. M. Hill, there was an increase in the production of American platinum in 1914 over that of 1913. Some 40,826 ounces of platinum were also obtained from refining scrap metals in sweepings of the jewelry and dental trades. Even if the imports of foreign platinum were greatly reduced, there are apparently sufficient stocks of the metal in the United States, it is declared, to meet domestic requirements. The price of platinum, which rose to $50 an ounce just after the war was declared, had by July, 1915, fallen to $37 an ounce, or $8 an ounce less than the average price in 1914. The increasing use of tungsten, molybdenum and nickel-chrome alloys in the electrical industry in place of platinum is said to have aided in bringing about the reduction in the price of the metal.

Oil Engine for Municipal Power Plants.—Mr. W. R. Haynie of the Bolinders Company, 30 Church Street, New York, agent for the J. & C. G. Bolinders Mek. Verkstands A. B., Stockholm, Sweden, manufacturer of heavy crude-oil engines, reports that his company has recently received orders for two 275-hp. oil engines for operating sixty-cycle generators in the municipal plant at Butler, N. J., and two 360-hp. engines for operating sixty-cycle generators in the municipal plant at Perth Amboy, N. J. The company has also just received from Charles R. Butters & Company, 120 Broadway, New York, an order for two 360-hp. engines which will be connected to drive alternators. Mr. Haynie states that the Bolinders engines are very popular for marine use and that a number of ships in various parts of the world are operated by these units. Although only established about a year ago, the Bolinders Company, Mr. Haynie declared, has found a keen interest shown in its oil engine in this country, a fact which it feels presages well for the future.

Inquiries from Foreign Countries Regarding Electrical Apparatus.—The Kern Commercial Company, exporter and importer, 114 Liberty Street, New York, has recently received a number of inquiries for electrical specialties and machinery for export to Italy and Spain. These inquiries cover motors, generators, transformers, insulating tubing, electric heaters, domestic appliances, bells and telephone and telegraph material. A large amount of the electrical material heretofore supplied to the concerns making these inquiries has come from Germany, which source is naturally now closed to them. Prospects in other countries are very good, Mr. M. Greenebaum of the Kern Company declares, but results cannot be obtained until after the end of the war. Whatever is done now will be principally in the line of missionary work. The American manufacturers are meeting with difficulties in the export field, Mr. Greenebaum declares, because their standards are different from those of European manufacturers. It is the opinion of Mr. Greenebaum that when American goods are once introduced into a country they will hold their place in the market even after the close of the war. As soon as peace is declared, he states, there will be a considerable increase in the amount of foreign business. At the present time one of the great deterrents to the expansion of foreign business is the lack of tonnage, which is resulting in enormously high freight rates. As soon as the war is over the release of many merchant ships which now are employed by the belligerents will serve to bring rates again to a fairly normal condition. Reasonable rates, however, will not be available for some time. As soon as the war is over the banking situation will also be improved, and this will help to put through many negotiations which for the present are hanging fire because of the disturbed conditions.

Orders for Electrical Apparatus.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has recently received the following orders: One 1875-kva., 2300-volt waterwheel generator for the Western States Gas & Electric Company of Placerville, Cal., through H. M. Byllesby & Company of Chicago; two 1875-kva., 2300-volt turbo-generator units for the Union Light, Heat & Power Company, Fargo, N. D., through H. M. Byllesby & Company, Chicago; one 6825-kva. synchronous frequency-changer set which is to take energy from a 13,000-volt, twenty-five-cycle line and transform it into 4000 volts, 62.5-cycle energy, and which is practically a duplicate of a Westinghouse set now installed for the Consolidated Gas, Electric Light & Power Company, Baltimore, Md.; one 6250-kva., 4000-volt turbine unit with auxiliary equipment for the Citizens' Light, Heat & Power Company, Johnstown, Pa.; one 6250-kva., 4000-volt turbine unit with auxiliary equipment for the Merchants' Heat & Light Company, Indianapolis, Ind.; one 3125-kva. turbine unit with auxiliaries for the Counties Gas & Electric Company, Norristown, Pa.; two 2500-kva. (11,000 volts high-tension side, 2400 volts low-tension side) oil-cooled transformers for the Hartford Electric Light Company, Hartford, Conn., through the Stone & Webster Engineering Corporation; two stationary substations, each consisting of a 500-kw. motor-generator set (2300-volt synchronous motor and 1500-volt direct-current generator) and a 10-kw. directly connected exciter, three 235-kva.,

single-phase, 45,000/2300-volt transformers with switchboard, and a portable substation with similar equipment using three 187.25-kva. transformers, for the Ogden, Logan & Idaho Railway Company, Ogden, Utah; one 900-kva., 11,000-volt, three-phase, two-bearing horizontal coupled-type generator for waterwheel drive with 11.5-kw. directly connected exciter, one 250-kva., single-phase, sixty-cycle, 33,000/11,000-volt transformer, one 250-kva., single-phase, 3306 2300-volt transformer and one six-panel switchboard for the Stevens County Power & Light Company, Colville, Wash.; one 1800-kw., 3400-volt turbo-generator unit with directly connected exciter, three 500-kva., 33,000/2300-volt transformers and twenty-one single-phase, 33,000/2300-volt transformers for the River Power Company, Sprigg, W. Va.; one 20,000-kw., 400-volt turbo-generator unit, one 25,000-sq. ft. surface condenser with auxiliaries and two 2000-kva., 33,000/4000-volt transformers for the Toledo Railways & Light Company, Toledo, Ohio; one 1000-kw., 600-volt direct-current rotary converter, three 365-kva. air-blast transformers, one 350-kva. testing transformer, one 350-kva. regulating transformer and one 2500-kva. inductance coil for the Public Service Electric Company, Newark, N. J.; one 900-kva. alternator of the vertical waterwheel type, to be operated at 6600 volts, for the Northern Virginia Power Company, Winchester, Va.; five 200-kva. transformers for the Lackawanna & Wyoming Valley Railroad Company, Scranton, Pa.

NEW YORK METAL MARKET PRICES

	Aug. 3 Selling Prices Bid	Aug. 3 Selling Prices Asked	Aug. 10 Selling Prices Bid	Aug. 10 Selling Prices Asked
Copper	£ s d		£ s d	
London, standard spot*	71 5 0		69 0 0	
Prime Lake	18.25	to 18.50	17.62½	to 17.87½
Electrolytic	18.00	to 18.25	17.37½	to 17.62½
Casting	16.87½	to 17.12½	16.50	to 16.75
Copper wire base	19.25	to 19.50†		19.00†
Lead		5.25		4.50
Nickel	50.00	to 52.00†	50.00	to 52.00†
Sheet zinc, f.o.b. smelter		24.00†		21.00†
Spelter, spot	17.25	to 17.50†	14.25	to 14.75†
Tin—straits		35.50		34.50
Aluminum, 98 to 99 per cent	32.00	to 33.00	32.00	to 34.00

*OLD METALS

Heavy copper and wire	16.50	16.00
Brass, heavy	11.75	11.25
Brass, light	10.00	9.50
Lead, heavy	4.65	4.25
Zinc, scrap	13.50	11.00

*COPPER EXPORTS

Total tons to Aug. 10 3,805

*From daily transactions on the New York Metal Exchange.
†Nominal.

New Industrial Companies

The Electric House-Lighting Company of Indianapolis, Ind., has been incorporated with a capital stock of $25,000 by Carl L. Rost, John M. Schmid and Earl F. Gray. The company proposes to manufacture and deal in electrical fixtures.

The Vosburgh Miniature Lamp Company of East Orange, N. J., has been incorporated with a capital stock of $25,000 to manufacture batteries, etc. The incorporators are David A. McBride, Gordan Grand and L. Matthews, all of East Orange, N. J.

The O. H. Electric Company of Chicago, Ill., has been incorporated with a capital stock of $10,000 by Richard M. Winters, Emil Kekick and J. H. Westover. The company proposes to manufacture electrical appliances and to do a general manufacturing business.

E. H. Tiffany & Company of New York, N. Y., have been incorporated with a capital stock of $25,000 by E. H. Tiffany, 90 West Street, New York; J. W. Stone and Glenn M. Congdon of New York. The company intends to manufacture and deal in electrical apparatus.

The Notowl Manufacturing Company of Syracuse, N. Y., has been incorporated with a capital stock of $100,000 to manufacture and deal in mechanical devices and specialties and hardware and to do electrical work. The incorporators are J. F. Lemp, J. O'Donnell and J. J. Albrecht of Syracuse.

The Latin-American Public Works Corporation has filed articles of incorporation under the laws of the State of Delaware for the purpose of developing business in Latin America. The company is capitalized at $1,000,000 and will seek to acquire concessions and contracts for public works or for extension or improvement of existing public utilities. The incorporators are J. G. White, Douglas L. Severd and Mallet Provost, all of New York, N. Y.

The Universal Electric Specialty Manufacturing Company of New Orleans, La., has been organized with a capital stock of $500,000 by William P. Connery and others. The company will manufacture electric signs, electric sign flashers, switchboards, electric time clocks, panelboards, cabinets, electric incubators, electric fans, small motors and electric specialties. Negotiations, it is reported, have practically closed for a site on Carrollton Avenue, where the manufacturing plant will be erected, at a cost of about $40,000.

New Incorporations

The Farm Power Company of Salisbury, N. C., has been chartered with a capital stock of $15,000 by Robert W. Sinclair and others.

The Royse Ice & Electric Company of Royse, Tex., has been chartered with a capital stock of $16,000 by J. T. Murphy, A. F. Davis and E. C. Murphy.

The Urich Electric Light & Power Company of Urich, Mo., has been incorporated with a capital stock of $5,000 by J. J. Wright, Henry Buesse and R. T. Miller.

The Farmers' Electric Company of Heyburn, Idaho, has been incorporated for the purpose of securing electrical energy from the reclamation plants in connection with the Minidoka project. The incorporators are J. F. Nelson, J. A. Plowman, J. M. Butler, W. T. McDermott and Robert Kenner.

Trade Publications

Lamp Tester.—An illustrated leaflet on an incandescent-lamp-testing instrument or watt indicator has been issued by the Eldredge Electric Manufacturing Company, Springfield, Mass.

Electric Washing Machines.—A vacuum-type electrically operated washing machine is described and illustrated in a booklet issued by the Wayne Manufacturing Company, 124 Sidney Street, St. Louis, Mo.

Starters for Induction Motors.—Bulletin No. 156, issued by the Crocker-Wheeler Company, Ampere, N. J., contains information on several recently developed starters for squirrel-cage induction motors.

Electric Arc Welding.—The Lincoln Electric Company, East Thirty-eighth Street and Kelley Avenue, Cleveland, Ohio, has just issued an illustrated catalog which contains information on its motor-generator outfit for electric-arc welding.

Spacing Switch Boxes.—The William Wurdack Electric Manufacturing Company, St. Louis, Mo., for which W. Douglas Woolley, 30 North Michigan Boulevard, Chicago, Ill., is general sales representative, has issued an illustrated leaflet on its metal switch boxes.

Automatic Switch for Small Generating Plant.—A type B automatic switch or cut-out for switchboards of small generating outfits is described and illustrated in Bulletin No. 13, which has been issued by the Hartman Electrical Manufacturing Company, Mansfield, Ohio.

Illumination of Show Windows and Factories.—Simplex Conduits, Ltd., Garrison Lane, Birmingham, England, have published the second number of a pamphlet entitled "Installation News," which contains information on the illumination of show windows and factories.

Fuses and Conduit Fittings.—The Killark Electric Manufacturing Company, for which W. Douglas Woolley, 30 North Michigan Boulevard, Chicago, Ill., is general sales representative, has issued illustrated leaflets which contain information on inclosed fuses and conduit fittings.

Construction News

New England

PORTLAND, MAINE.—The Cumberland County Pwr. & Lt. Co. of Portland, it is reported, is contemplating the construction of a new dam across the Presumpscott River at North Gorham.

MANCHESTER, N. H.—The Manchester Trac., Lt. & Pwr. Co. has been granted a permit to build a new power plant at Brook and Pennacook Streets, and also to enlarge substation at Kelley's Falls.

MAYNARD, MASS.—The Board of Selectmen has signed a new contract with the American Woolen Co. for street-lighting for a term of from three to five years. Under the terms of the new contract the arc lamps now in use will be replaced with 60-cp. nitrogen-filled incandescent lamps (four for each arc lamp); all the 40-cp. lamps will also be replaced with the nitrogen-filled lamps.

MILLBURY, MASS.—The Millbury Wtr. Co. is reported to be considering changing the motive power of its pumping station from steam to electricity.

WESTFIELD, MASS.—New equipment will be purchased for the municipal electric-lighting system as follows: Motor-generator set for testing purposes, recording integrating wattmeters, testing instruments, transformers (number and rating not yet decided upon), poles, white-glazed porcelain insulators for primary lines, copper wire for transmission line, Gaston Daniels lightning arresters and Matthews fuse cut-outs. A coal trestle, oil house and storehouse will also probably be erected. The town recently authorized an expenditure of $25,000 for improvements to the municipal lighting plants. G. E. Mitchell is manager.

HARTFORD, CONN.—A permit has been granted to the Stone & Webster Engineering Corpn. of Boston, Mass., to erect a three-story brick addition to the Dutch Point power station of the Hartford El. Lt. Co., to cost about $35,000.

NEW LONDON, CONN.—Plans are under way, it is reported, for the construction of a new electric generating station and boiler plant for the Connecticut Pwr. Co. in New London. All the present buildings on the site, it is understood, will be removed and replaced by new structures.

WINDSOR, CONN.—Bids will be received by the Board of Commissioners of the Windsor Fire District until Aug. 20 for construction of a water-works system, including electrically driven pumping equipment. H. R. Turner is superintendent.

Middle Atlantic

ALBANY, N. Y.—Plans are being prepared by the Obenaus-Nichols Co., architect, it is reported, for the construction of a fire-alarm and police-signal station for the city of Albany.

ALBANY, N. Y.—Bids will be received by the Board of Contract and Supply, City Hall, Albany, until Sept. 7 for construction and equipment of two sewage-pumping stations, including superstructures for a main pumping station, gatehouse, tool house and auxiliary automatic pumping station, railroad track, storage-battery locomotive, electrically operated locomotive crane, Venturi meter, etc. Separate bids will also be received for necessary plumbing, heating and ventilating and electric wiring and fixtures. The equipment of the pumping stations will include three 10,000,000-gal., three 15,000,000-gal. and two 1,500,000-gal. (daily capacity) motor-driven centrifugal pumps, switchboards, suction and discharge pumps and discharge piping, etc. Plans and specifications may be obtained upon application to Frank R. Lanagan, city engineer, for which a deposit of $25 will be required for each set or part thereof.

BINGHAMTON, N. Y.—Steps have been taken by the merchants and property owners of Court Street, between Exchange and Carroll Streets, for the installation of an ornamental lighting system, to cost from $9,000 to $10,000.

CANISTEO, N. Y.—The proposal to secure electrical service from the Hornell El. Co. of Hornell will soon be submitted to the voters.

DUNKIRK, N. Y.—The Dunkirk El. Mfg. Co. is installing two new boilers in its power plant. H. T. Litchfield is secretary.

EAST AURORA, N, Y.—The East Aurora El. Lt. Co. has recently completed the installation of two new generators and switchboard and also the erection of a transmission line to Wales Center. Within the next thirty days the company expects to purchase electric appliances and supplies, including heating and cooking apparatus, vacuum cleaners, washing machines, wiring supplies, etc. R. S. Persons is secretary and treasurer.

EAST WORCESTER, N. Y.—The Great Bear Lt. & Pwr. Co. of East Worcester expects to erect about 3 miles of pole transmission line within the next three months. William F. Shupe is treasurer.

GOUVERNEUR, N. Y.—The Oswegatchie Lt. & Pwr. Co. of Gouverneur, it is reported, is contemplating the development of the water-power once used by the United States Talc Co. of Hyatt. The mill property was destroyed by fire several years ago, but the dam, flume and waterwheels, it is said, are in good condition. A minimum of 3000 hp., it is expected, can be developed there.

GOWANDA, N. Y.—The Village Board has entered into a contract with the Keyes El. Co. of Gowanda for lighting the streets of the village. Under the new contract the present arc lamps will be replaced with 50 arc lamps of 400 cp. and 125 incandescent lamps of 100 cp. The company has also agreed to reconstruct its plant, to be operated by steam, and to make other improvements, at a cost of about $20,000.

HERMON, N. Y.—The Hermon El. Lt. Co. expects to purchase an 8-kw. transformer at once. W. G. Popple is secretary and manager.

MOUNT MORRIS, N. Y.—The Mount Morris Illg. Co., it is reported, has begun work on construction of a new power plant near the power dam in the Genesee River on the Leicester side.

NEWFANE, N. Y.—The Newfane El. Co. is considering the question of installing additional equipment in its plant or purchasing energy from the Lockport Lt., Ht. & Pwr. Co. during the low-water periods in the Eighteen Mile Creek. If power is purchased from the Lockport company, the Newfane company will erect a transmission line between this city and Lockport.

SYRACUSE, N. Y.—Plans are being prepared, it is reported, by the Globe Malleable Iron & Steel Co. of Syracuse for a power house to be built in connection with its works.

WOODHAVEN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, until Aug. 23 for installing electrical equipment in new Public School 97, corner of Yarmouth and Shipley Streets, Woodhaven, borough of Queens. Blank forms, plans and specifications may be obtained at the above office and also at the branch office, 69 Broadway, Flushing.

CANONSBURG, PA.—The West Penn Ltg. Co. has closed a contract with the Standard Tinplate Co. whereby it will supply energy to operate the tin-plate plant in East Canonsburg. The Standard company is erecting a 12-mill addition to its plant there. A high-tension transmission line will be erected from Canonsburg to the Standard Works.

EAST BERLIN, PA.—A committee has been appointed to make investigation as to the feasibility of establishing a municipal electric-light plant to supply electricity for municipal and commercial purposes.

HARRISBURG, PA.—Application has been made to the State Department for approval of three electric companies, known as the Farmers' El. Co. of North Lancaster County, Farmers' El. Co. of Penn Township, and Farmers' El. Co. of Warwick Township. The incorporators are composed of residents of Lancaster and Chester Counties.

JEFFERSON PA.—The West Penn El. Co. of Pittsburgh will apply to the Public Service Commission for approval of a contract with the township of Jefferson for the purpose of constructing an electric-lighting and power system in the township.

NEW BRIGHTON, PA.—Negotiations have been closed whereby the control of the Beaver County Lt. Co. of New Brighton and the Midland El. Co. have passed into control friendly to the Duquesne Lt. Co. of Pittsburgh. Improvements involving an expenditure of $500,000 on new equipment, it is reported, will be made by the new company in the near future.

WEATHERLY, PA.—The directors of the Middle Coal Field Poor District have contracted with town of Weatherly to supply electricity from the municipal electric-light plant to the poor-farm at Laurytown. Work will begin at once on the erection of the transmission line from Weatherly to the poor-farm.

ALLENTOWN, N. J.—Improvements, including the installation of some new machinery, have recently been completed to the municipal electric-light plant. Charles S. Joiner is superintendent.

NEWARK, N. J.—To provide for additional lighting service at the penitentiary the Board of Freeholders has decided to request the finance committee for an extra $10,000 in the bond issue for the new wing and warden's home. It has been proposed to issue $135,000 in bonds for additions to the penitentiary.

BALTIMORE, MD.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 31, for the installation complete of an elevator plant in the United States immigration station, Baltimore, Md. For details see proposal columns.

BALTIMORE, MD.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 31, for mechanical equipment (except elevators, lift and dumbwaiter) of the immigration station at Baltimore, Md., in accordance with drawings and specifications, copies of which may be obtained at the above office.

KEYSER, W. VA.—The Keyser El. Lt. Co., it is reported, is contemplating increasing the output of its plant and installing additional machinery.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 18, for furnishing and installing lighting fixtures in the United States post office buildings at Berkeley, Cal., and Denver, Col., in accordance with plans and specifications, copies of which may be obtained at the above office.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 31, for installation complete of an electric passenger elevator in each of the following buildings: The United States post office and court house at Amarillo, Tex., and the United States post office and court house at Medford, Ore. For details see proposal columns.

WASHINGTON, D. C.—Foreign trade opportunities are announced by the Bureau of Foreign and Domestic Commerce in the Commerce Reports as follows: No. 17,618—An engineer in Spain informs an American consular officer that he is interested in the importation of agricultural, industrial and electrical machinery. No. 17,646—An American consular officer in England writes that an electrical supply dealer in his district is desirous of purchasing glass bulbs for incandescent lamps, complete with vitrate filling. A sample of brass cap, together with designs of bulbs, may be examined at the above bureau or its branches. No. 17,728—The Spanish government has authorized the Minister of the Interior, through the General Director of Post and Telegraph, to purchase 35 tons of galvanized-steel wire 2 mm. in diameter, 40 tons 3 mm. in diameter, 100 tons 4 mm. in diameter, and 25 tons 5 mm. in diameter. This wire is to be used in the national telegraph and telephone service. No. 17,685—An American consular officer in Wales has transmitted a detailed report relative to an opportunity for the sale of electric fans, irons, dusters, lamps, etc. No. 17,790—A firm in Norway writes an American consular officer that it wishes to hear from American manufacturers and exporters of rubber tires, automobile accessories, dry batteries and automobile trucks, with a view of securing an exclusive agency for the sale of these lines. No. 17,813—This bureau is in receipt of a letter from a business man in India stating that he desires to correspond with American manufacturers and exporters of hardware, machinery, agricultural implements, pumps, electric lamps, holders, metal filament, drawn-wire lamps, electric fans, etc. No. 17,819—An American consular officer in the Far East has transmitted a report, together with blueprints, specifications, etc., relative to the opportunity for the installation and supply of equipment for a telephone system. No. 17,821—An American consular officer in India reports that an electrical engineer in his district desires to be placed in communication with an American manufacturer of electrical goods used in hotels and office buildings, particularly electric fans. This man is about to furnish the electrical equipment for a large hotel. No. 17,831—An electric tramway company in Greece has advised an American consular officer that it is in the market for electrical supplies, especially "engrenages" and "pignons" (large and small cogwheels). No. 17,834—An electric company in England informs an American consular officer that it is in the market for glass shades for electric lamps; also glass disks for electric-lamp pendants. Further information may be obtained at the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., and its branches.

North Central

ALBION, MICH.—Plans have been completed for the Epworth League physical laboratory for Albion College, which call for a building 50 ft. by 80 ft., two stories and basement. In the basement will be situated the electrical laboratory, battery room, physical room, heating plant and molding room. Fred J. Herrick of Albion is architect.

FENTON, MICH.—The power plant of the Fenton Lt. & Pwr. Co., which has been closed down for a year, will be used by the Flint El. Co. to furnish electricity for the local service while the Flint company is rebuilding the trunk line from Flint to Fenton. A new generator is being installed.

MARINE CITY, MICH.—The Marine City Roller Mill Co. has sold its electrical plant, including equipment and business, and also a strip of land back of the mill, for a site for substation to the Eastern Michigan Edison Co. of Detroit. The latter company will begin work at once to rewire the entire town and will make many other improvements to the local system.

RAPID RIVER, MICH.—A franchise has been granted to H. E. Pheiffer to furnish electricity for commercial purposes in Rapid River.

STEPHENSON, MICH.—Bonds to the amount of $5,000 have been voted for the installation of an electric light and power plant.

ANTWERP, OHIO—A. A. Pointer, owner of the local electric-light plant, has closed down his power house and is purchasing energy from the Hicksville station. The entire equipment of the plant is for sale. Mr. Pointer has recently completed the transmission line from Woodburn to Mayesvile and Grabill, Ind.

ARCADIA, OHIO—The Arcadia El. Lt. Co. has recently installed a new oil engine. P. A. Wheland is owner.

CANTON, OHIO.—Under authority recently granted by the City Council extending the rights of the public utility companies to place their wires underground, the Ohio State Telephone Co., the Northern Ohio Traction Co. and the Canton El. Co. will increase considerably the amount of underground conduit work which will be done in the future.

CINCINNATI, OHIO.—Application has been made by Harry G. Smith of Cincinnati for a franchise to operate an electrically operated moving sidewalk at the foot of Front Street to connect with the Coney Island boats.

CRESTLINE, OHIO.—Bids will be received by the village of Crestline until Aug. 18 for furnishing and operating an electric street-lighting system for a period of ten years.

EAST YOUNGSTOWN, OHIO. — The Council has awarded the contract for lighting the streets of the city for a period of ten years to the Youngstown & Sharon St. Ry. Co. The system will practically be the same as used in Youngstown, all wires on main streets to be placed in conduits and the lamps on side streets to be hung on brackets.

LIMA, OHIO.—Arrangements are being made by the Ohio El. Co. to place its wires underground in the downtown district in compliance with its franchise. H. G. Gilpin is superintendent.

McCONNELSVILLE, OHIO.—Within the next three months the McConnelsville-Malta El. Co. expects to purchase one 250-hp. gas engine and one or two carloads of poles. W. A. Cosgrave is secretary.

ORRVILLE, OHIO—The Massillon El. & Gas Co. of Massillon expects to rebuild its local distribution plant in 1916. Herman B. Cohen is manager.

SPENCERVILLE, OHIO.—Bids will be received by the Board of Public Affairs, Spencerville, until Aug. 20, for construction of addition to power house, and for furnishing boilers, engine, generator, etc., for the municipal electric-light plant. For details see proposal columns.

FORT THOMAS, KY.—The Highland Film Corpn., it is reported, is contemplating the construction of a power plant, to cost about $30,000.

PADUCAH, KY.—An isolated electric-light and power plant will be installed in connection with the garage (to cost $35,000), to be built by the Foreman Automobile Co. in Paducah.

BOONVILLE, IND.—Improvements are being made to the mine of the Big Four Coal Co., near Boonville, which include the installation of electrical operating and shaft equipment, to cost about $75,000. John E. Kelley, George Nestor and others are interested in the company.

HUNTINGTON, IND.—The Casewell-Runyon Co. of Huntington is installing electric generating equipment to provide electricity to operate its plant.

INDIANAPOLIS, IND.—The Merchants' Ht. & Lt. Co. of Indianapolis will erect a high-tension transmission line from the terminus of its present lines to a center at Avon, where it will supply energy at wholesale to the Danville company, which has a distribution system covering considerable territory in Hendricks Coputy. Hugh H. Harrison is president of the Merchants' company.

NORTH VERNON, IND.—The North Vernon Lumber Co. will install a 100-kw. electric plant to furnish electricity to operate its lumber mill. The equipment will include one 72-in. by 18-ft. boiler (125-lb. pressure), one 100-kw., 220-volt alternating-current generator and steam engine to drive same, and also switchboard. Contracts have not yet been awarded. F. M. Platter is president.

ALTON, ILL.—Bids will be received by the Board of Administration, Capitol Building, Springfield, until Aug. 23, for construction of power house at the Alton State Hospital, near Upper Alton. Plans and specifications may be obtained upon application to James B. Dibelka, state architect, 130 North Fifth Avenue, Chicago.

GALENA, ILL.—To meet increasing demands for electrical power in the Illinois-Wisconsin zinc-mining field the Interstate Lt. & Pwr. Co. of Galena, a subsidiary of the Northern States Pwr. Co., will increase the output of the Galena station. A new 2500-kw. steam turbine will be installed, together with a number of improvements in the boiler room.

UPPER ALTON, ILL.—Bids will be received by the Board of Administration, Capitol Building, Springfield, until Aug. 23 for the erection of a power house at the Alton State Hospital, near Upper Alton. Plans and specifications may be obtained upon application to James B. Dibelka, state architect, 130 North Fifth Avenue, Chicago.

WARSAW, ILL.—The merchants and the City Council, it is reported, are considering the installation of an ornamental lighting system.

APPLETON, WIS.—At a mass meeting held recently the citizens adopted a resolution authorizing the City Council to install single nitrogen-filled lamps on Corinthian posts (eight to the block) to replace the arches and arc lamps now in use.

CHIPPEWA FALLS, WIS.—Plans are being considered for the installation of an ornamental lighting system in Chippewa Falls, covering eight blocks.

RACINE, WIS.—The Wisconsin Gas & El. Co. of Racine has purchased the property of the Burlington El. Lt. & Pwr. Co. of Burlington and the Watertown Gas & El. Co. of Watertown. The Wisconsin Gas & El. Co. also proposes to take over transmission lines supplying electricity to several towns south of Watertown. D. E. Callender of Racine is general manager of the Wisconsin company.

KASSON, MINN.—Plans, it is reported, are being prepared by J. F. Druar, Commercial Bank Building, St. Paul, for improvements to the municipal electric-light plant.

ROCHESTER, MINN.—The City Council has rejected the offer of the Consumers' Pwr. Co. of St. Paul to supply electricity here. The Utility Board has been authorized by the Council to begin operations for the construction of a new municipal electric plant, to cost about $125,000. The purchase of the site of the Zumbro Pwr. Co. at Zumbro Falls is reported to be under consideration by the Council, and it may be developed in the near future to furnish power to generate electricity. The Charles L. Pillsbury Engineering Co., Metropolitan Life Building, Minneapolis, has been engaged to take charge of the construction of the proposed new plant.

ST. JAMES, MINN.—Bids will be received by the Common Council of the city of St. James until Aug. 20 for furnishing and installing equipment in the municipal electric light and water plant as follows: One 500-gal. Underwriters' fire pump, one 50-hp. motor, one 100-kw. W. generator with belt-driven exciter, one deep-well pump, one 15-hp. motor, two 7½-kw. W. transformers, one 10-kw. W. constant transformer with two-circuit panel, three panelboards, lightning arresters, choke coils, meters, etc., piping, wiring, preparing foundations. Plans and specifications may be seen at the office of the city clerk of Sauk City, and also on application to Christ Larsen, St. James.

ST. PAUL, MINN.—The Consumers' Pwr. Co., a subsidiary of the Northern States Pwr. Co., has recently signed a contract to furnish energy to operate 2665 hp. in motors in the shops of the Great Northern Ry. Co. and roundhouse in St. Paul. Service will soon begin to the new Railroad Building, where the company will supply 2100 hp. for lamps and motors.

CHARLES CITY, IOWA.—The Cedar Valley Hydraulic Co. of Charles City has been granted a twenty-year franchise by the Board of County Supervisors to erect transmission lines to distribute electricity from Janesville south to Cedar Falls and Waterloo and along several roads adjacent to Cedar Falls.

CHARTER OAK, IOWA.—Contract for the construction of the municipal electric-light plant has been awarded by the City Council. Mr. Boynton of the firm of Bruce, Standevin & Boynton, Bee Building, Omaha, Neb., is consulting engineer. B. O. Millman has been engaged to take charge of the plant when completed.

FOREST CITY, IOWA.—Bids will be received by Dr. H. R. Irish, president of the independent school district of Forest City, Forest City, until Aug. 25, for construction of a new high and grade school, including general costruction work, heating and plumbing, electrical work and fixtures, manual training, domestic science and gymnasium equipment. Plans and specifications may be secured at the office of Alban & Lockhart, architects, Endicott Building, St. Paul, Minn., upon deposit of $10.

NORTH ENGLISH, IOWA.—The Iowa El. Lt. Co. of Marengo, it is reported, has been granted a franchise to supply electricity in North English. The transmission line will be extended from Williamsburg to Parnell.

POPLAR GROVE, IOWA.—The local electric-light plant, owned by Warren M. Webster, was recently destroyed by fire, causing a loss of about $10,000.

RIVERTON, IOWA.—At an election held recently the proposal to grant the Hamburg El. Lt. Co. of Hamburg a franchise to supply electricity in Riverton was carried.

SOLON, IOWA.—An election will soon be called to submit the proposal to grant the Iowa Ry. & Lt. Co. of Cedar Rapids a franchise to supply electricity in Solon. If granted a franchise, the company will extend its high-tension transmission line from Mount Vernon to Solon.

WATERLOO, IOWA.—The Board of Supervisors of Black Hawk County has granted the Citizens' Gas & El. Co. of Waterloo a franchise to erect transmission lines through certain portions of Black Hawk County for a period of twenty years.

PICKERING, MO.—The Marysville El. Lt. Co. of Marysville has been granted a franchise to supply electricity in Pickering for a period of ten years and also a ten-year contract for street lighting.

PEMBINA, N. D.—Charles E. Fiers of the Dodge County Pwr. Co., it is reported, has been granted permission to construct and operate an electric-light plant in Pembina.

WHITE EARTH, N. D.—The Village Board is considering the installation of a new electric-light plant and also a new street-lighting system this summer.

BARNSTON, NEB.—The State Board of Irrigation has approved the application for permission to install a hydroelectric power plant at Barnston to supply electricity to towns along the Blue River. George W. Steinmeyer of Holmesville is promoter.

BLAIR, NEB.—Bids will be received by the village clerk until Aug. 30 for the construction of an electric-light plant. The Martz Engineering Co., First National Bank Building, Lincoln, has charge of the engineering work.

CLAY CENTER, NEB.—Within the next three months the M. M. Johnson Lt. & Pwr. Co. of Clay Center expects to erect twelve miles of 13,200-volt, single-phase transmission line; also to purchase material for the above line, including step-up transformers, lightning arresters and one-panel switchboard. B. C. Robinson is electrician.

FAIRBURY, NEB.—The electric light commission expects to purchase within the next ninety days 20 steel towers, 45 ft. high; also within the next twelve months one 300-hp. marine-type boiler. G. D. Myers is manager.

FRANKLIN, NEB.—Within the next two months the electric-light commissioners expect to erect a new power house and to purchase one 100-hp. steam engine, one 75-kva. generator and two boilers, with all equipment for same. A. S. Creighton is superintendent.

FULLERTON, NEB.—The Fullerton El. Lt. & Pwr. Co. expects to build within the next twelve months a concrete wheel pit and flue (reinforced construction). Other improvements not yet decided upon. C. N. Philbrick is secretary.

HARVARD, NEB.—Within the next six months the Harvard El. Co. expects to purchase an oil engine with a rating of about 100 hp. A. W. Person is secretary and manager.

LAUREL, NEB.—The Council, it is reported, has engaged Bruce, Standeven & Boynton, Bee Building, engineers, of Omaha, to prepare plans for the proposed municipal electric-light plant in Laurel.

SHELTON, NEB.—Bonds to the amount of $8,000 have been voted for the installation of a municipal electric light and power plant in Shelton.

CHAPMAN, KAN.—Bonds to the amount of $8,000 have been voted, it is reported, for the purchase of the local electric-light plant and for improvements to same.

EL DORADO, KAN.—The Kansas Gas & El. Co. of Wichita has purchased the local electric plant and proposes to erect a 22,000-volt transmission line from Valley Center to connect El Dorado with the Wichita plant. A substation will be erected here, equipped with the necessary transformers and switching apparatus, and an emergency gas-engine outfit. No new equipment will be required. H. S. Sladen of Wichita is manager.

KIRWIN, KAN.—The contract for construction of an electric-light plant, distributing system and city hall has been awarded to the F. D. Martin Construction Co., Rialto Building, Kansas City, Mo., at $14,-115.

LAWRENCE, KAN.—The Lawrence Ry. & Lt. Co. has submitted a proposal to the City Commissioners for the installation of a new street-lighting system. The plan provides for attaching brackets for lamps to the trolley poles of the street car company.

Southern States

AYDEN, N. C.—An election will be held Aug. 20 to vote on a proposal to issue $15,000 in bonds to install an electric-light system.

DUNN, N. C.—Within the next three months the Board of Public Works expects to install a generating unit (directly connected) in the municipal electric plant. A General Electric generator, engine and line material have already been purchased. L. V. Bizzell is superintendent.

LA GRANGE, N. C.—H. H. Sutton & Son, owners of the local electric-light plant, are building a new power house and are installing a 75-hp. Samson water turbine, which will be completed in about 30 days. They also expect to purchase within the next thirty days one 37-kw. to 50-kw. generator (would like to have prices on a second-hand machine in good order) and an oil engine from 50 hp. to 75 hp. The company has a 40-hp. second-hand Watertown engine, which it would like to trade in part payment for oil engine.

SOUTHPORT, N. C.—The Southport Lt. & Pwr. Co. expects to install within the next two months an 80-hp. crude-oil engine; also to purchase within the next three months 4000 ft. of No. 8 double-braided wire, two 20-kw. transformers and one 15-kw. transformer. Within the next six months the company expects also to purchase a new switchboard. George W. Rappleyea is president.

WAKE FOREST, N. C.—Within the next three months the electric-light committee expects to purchase one 150-hp. boiler, one 125-hp. automatic or turbine engine, one 75-kva., three-phase generator, one exciter, one switchboard and feeder panel. J. L. Bullard is superintendent.

BACONTON, GA.—The proposal to issue $12,000 in bonds will be submitted to the voters on Aug. 19. Of the proceeds $5,500 will be used for improvements and extensions to the municipal electric-light plant and water-works system.

FIVAY, FLA. (not a post office).—Plans are being prepared by the Fivay Improvement Co. for extensive developments in Fivay, including the installation of electric-lighting and water-works systems. Hiram McElroy, 410½ Franklin Street, Tampa, is engineer in charge of construction.

GUNTERSVILLE, ALA.—The Alabama Pwr. Co. of Birmingham has been granted a franchise to supply electricity in Guntersville. The company is now installing a small steam plant (using second-hand apparatus in stock) to supply electrical service here until such time as its high-tension transmission lines reach this part of the State. The company has accepted a contract for street-lighting and for furnishing electricity to operate the pumps for the city water system. The street-lighting system will consist of 40 100-watt tungsten lamps. F. H. Chamberlain is general manager.

JACKSONVILLE, ALA.—The Alabama Pwr. Co. of Birmingham has been granted a franchise to supply electricity in Jacksonville and also awarded a contract for street lighting. The company, it is said, will rebuild the local system (formerly owned by the Calhoun Lt. & Pwr. Co.) or install a new system connecting with its transmission line now being erected from Anniston to Piedmont.

WEST BLOCTON, ALA.—The Alabama Pwr. Co. is installing a distributing system in West Blocton and expects to begin service about Oct. 1. A 50-kva. substation will be erected in connection with its high-tension transmission line now under construction from Helena to Blocton. The company is negotiating for a contract for pumping the city water. The cost of the installation is estimated at $10,000.

NEW ORLEANS, LA.—The City Commission has engaged Frederick W. Ballard, chief engineer of the Cleveland (Ohio) municipal electric-light plant, to make investigations and the necessary surveys to prepare plans and estimates for a municipal electric-light plant. Commissioner Lafaye has authorized City Electrician Olroyd to install new lamps on several prominent thoroughfares in the city as soon as possible. The new lamps will be erected on ornamental standards similar to those in North Rampart Street and at West End Park.

MARSHALL, OKLA.—Bonds to the amount of $25,000 have been voted for the installation of a municipal electric light and power plant in Marshall.

SHAWNEE, OKLA.—The Shawnee Gas & El. Co. expects to purchase within the next three months 130 high-efficiency, series alternating-current street lamps of 400 cp. each to replace the 6.6-amp. lamps now in use. C. S. Thompson is chief engineer.

TULSA, OKLA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Sept. 27, for construction, including mechanical equipment and approaches, of the United States post office and court house at Tulsa. Drawings and specifications may be obtained at the above office or from the custodian of site at Tulsa.

AMARILLO, TEX.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 31 for installation of an elevator in the United States post office at Amarillo. For further information address James A. Wetmore, acting supervising architect.

AUSTIN, TEX.—J. C. Andrewartha of Dallas, consulting engineer of the Southwestern Trac. Co., has advised the Commissioners of Travis County that the company proposes to construct a trunk-line interurban railway from Dallas to Austin, with branch lines to San Angelo, Lockhart and a number of other towns. The proposed system will embrace several hundred miles of track.

DALLAS, TEX.—It is announced that work will soon begin on construction of the interlocking plant (which will cost $200,-000) in connection with the new railroad terminals and union station. C. H. Dana is chief engineer of the Union Terminal Co.

DALLAS, TEX.—The Dallas Pwr. & Lt. Co. plans to supply electricity in the towns of Troy, Eddy, Bruceville, Lorena, Thrall and Holland from the high-tension transmission line which it is erecting from Waco to Austin, a distance of about 100 miles. The company has also taken over the local electric plant at Moody, McGregor and Thorndale on the new line.

DECATUR, TEX.—Extensions and improvements to the municipal electric-lighting system are reported to be under consideration.

FROST, TEX.—The Texas Pwr. & Lt. Co. has taken over the property of the local electric-light company. Service will be rendered by means of a transmission line, tapping the main line at Hillsboro.

JOURDANTON, TEX.—Work has been started on construction of the municipal electric light and power plant in Jourdanton by Hudson & Braden of San Antonio, contractors.

MERKEL, TEX.—The property of the Merkel El. Co. is reported to have been purchased by the Abilene Gas & El. Co. of Abilene. The new owner, it is understood, proposes to make improvements to the system and erect a transmission line from Abilene to Merkel; also to erect a substation here.

MISSION, TEX.—The Mission Ice, Lt. & Wtr. Co., recently organized, has secured an electric-light and water-works franchise in Mission. Contracts, it is understood, have been placed for machinery. The company will also build a 20-ton ice factory. J. A. Sadler is president and manager.

PLAINVIEW, TEX.—The Malone Ice & Lt. Co., which is erecting a system of transmission lines in this section will supply electrical energy in the towns of Lubbock, Floydada, Lockney, Abernathy and Hale Center. It wil also supply electricity for operating many irrigating pumping plants.

SAN ANGELO, TEX.—Improvements, it is reported, are contemplated by the San Angelo Wtr., Lt. & Pwr. Co., including the installation of additional machinery, to cost about $50,000.

Pacific States

CENTRALIA, WASH.—H. G. Fleischhauer, who recently entered into a contract with the City Council to furnish energy to operate the municipal electric system for a period of five years, has filed a bond with the city that he will carry out the contract, which provides for the erection of a power house near Centralia and for furnishing the service by Oct. 1.

OLYMPIA, WASH.—Plans have been submitted to the City Council by O. H. Keen, state engineer, for an ornamental street-lighting system in the business district, to cost about $12,500, and one for the entire city, to cost $20,000. The plan proposed is to replace the arc lamps now in use with lamps on ornamental standards.

OLYMPIA, WASH.—Wilbur B. Foshay of the Washington Pub. Ser. Co. of Olympia has submitted a proposal to the Council for lighting the streets of the city. If granted the contract, it is proposed to utilize the steam-heating plant of the company, installing electric generators and other equipment, which will cost approximately $50,000.

PE ELL, WASH.—Negotiations are under way between the City Council and C. C. Smith, owner of the Morton El. Co. of Morton, relative to the installation of an electric light and power plant in Pe Ell.

SPOKANE, WASH.—Plans presented by the Northern Pacific Ry. Co. have been approved by the City Council for lighting the various bridges (19 in all) across the streets in the grade separation structure.

STANWOOD, WASH.—George W. Kunze of Arlington, who has recently been granted a 50-year franchise to furnish electricity in Stanwood, it is understood, will take over the local electric plant, owned by L. F. Query. The plant will be enlarged and extensions made to the system.

VASHON, WASH.—The Vashon-Maury Lt. & Pwr. Co. is contemplating extending its transmission lines between Dockton and the west side of Vashon and Maury Islands in the near future.

GRANT'S PASS, ORE.—At an election held recently the citizens voted in favor of granting a franchise to the Rogue River Pub. Ser. Corpn. of Grant's Pass to furnish electricity in Grant's Pass in competition with the company now operating here.

IONE, ORE.—The town of Ione has entered into a contract with the Heppner Lt. & Wtr. Co. of Heppner to supply energy to operate the municipal electric-lighting system, the service to begin Dec. 1. The company has secured a franchise from the supervisors of Morrow County to erect a transmission line to Ione and is negotiating with the town officials of Lexington to supply electrical service there. It will also furnish electricity to farmers residing along the line.

CHICO, CAL.—The Northern California Pwr. Co. of California is preparing to reconstruct its power line from a substation at Nord and Stewart Avenues into Chico.

LONG BEACH, CAL.—Extensive improvements are under way by the Pacific Tel. & Teleg. Co., which will include a large expansion of its lines in the northwest part of the city and underground wiring in the business section, and also the installation of new cable. The cost of the work is estimated at $30,000. J. L. Adams is local superintendent.

LOS ANGELES, CAL.—The City Council has instructed the city engineer and city attorney to prepare an ordinance for erection of ornamental lamps on Hobert Boulevard from Washington Street to Harvard Boulevard.

MERCED, CAL.—Municipal ownership of the local electric-lighting plant is under consideration by the Council.

PASADENA, CAL.—An election will soon be called to submit to the voters a proposal for installing ornamental lamps on about eighteen miles of streets.

BLISS, IDAHO.—The Utilities Commission has granted the Idaho Pwr. & Lt. Co. of Bliss permission to cut over its transmission lines at Mountain Home to the lines of the Great Shoshone & Twin Falls Lt. & Pwr. Co. in order to transmit electricity to the amount of 2500 kw. to districts in southwestern Idaho to operate pumping plants in connection with irrigation projects.

FAIRFIELD, IDAHO.—Estimates are being prepared with a view of establishing a municipal electric-light plant in Fairfield. The plans provide for a 75-hp. Diesel engine and storage batteries. It will proba-

bly be operated in connection with the water-works system. H. A. Stroud, manager of the town-site company, is interested in the project.

PROVO, UTAH.—Preliminary surveys are being made for the proposed municipal electric light and power plant.

SALT LAKE CITY, UTAH.—Plans have been completed by the Utah Pwr. & Lt. Co. of Salt Lake City to extend its transmission lines into Emery and Carbon Counties to furnish electrical service in that territory.

SALT LAKE CITY, UTAH.—Plans are being considered to equip the repair shops of the Denver & Rio Grande Railroad in Salt Lake City for electrical operation.

BOZEMAN, MONT.—Bids will be received by C. A. Spieth, city clerk, Bozeman, until Aug. 19 for furnishing and installing an ornamental lighting system in special improvement district 100. According to reports the plans provide for 74 combination lighting fixtures and trolley suspensions, 16 three-lamp cluster posts, 9200 ft. of No. 6 wire park cable, etc.

BUTTE, MONT.—The City Council is contemplating taking up the project for installing an ornamental lighting system throughout the business section which was planned two years ago. This provides for the erection of ornamental lamps, similar to those on Main Street, for the entire business district, at a cost of about $35,705.

DEER LODGE, MONT.—The Council is considering plans for dividing the city into eleven improvement districts for the purpose of installing and operating electric lamps in residence districts similar to those now in use in the business section of the city.

DILLON, MONT.—The City Council has voted to create a special improvement district for the installation of an ornamental lighting-system. Bids for materials and installation, it is understood, will be called for soon.

CARLSBAD, N. M.—The power plant of the Public Utilities Co., which serves Carlsbad and the government reclamation project, will be enlarged. The lower dam on the Pecos River will be raised and an additional generator installed, and the transmission line (6 miles long) from the plant into Carlsbad will be rebuilt to carry 6600 volts.

Canada

WINNIPEG, MAN.—Plans have been prepared by W. P. Brereton, city engineer, for an extension to the heating and power plant of the municipal hospital.

AYLMER, ONT.—A company is being organized by W. J. Conroy of Aylmer for the purpose of installing an electric-light plant here.

FALLS VIEW, ONT.—The contract for the erection of distribution lines in Falls View has been awarded to the Carter El. Co. of Niagara Falls. As yet no arrangements have been made by the Township Council for supply of electrical energy, pending information from the Ontario Hydro-Electric Power Commission as to rates.

MILVERTON, ONT.—At an election held recently the by-law providing for the installation of a hydroelectric system was carried.

NIAGARA FALLS, ONT.—The Board of Estimate and Apportionment of Niagara Falls has approved of the appropriation of $25,000 in the 1916 budget for illuminating the cataracts of Niagara Falls. This is the first official step in the movement to illuminate the falls permanently.

PORT ROWAN, ONT.—The Town Council is securing estimates of the cost of installing an electric-lighting plant.

Miscellaneous

PANAMA.—Plans are being considered by the Republic of Panama for the development of a number of waterfalls in the interior to generate electricity. It is proposed to invite foreign capital to undertake the lighting of several of the important interior towns in the vicinity of which ample water-power exists.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Aug. 27, for furnishing steel boiler tubes, cable clips, cable thimbles, twist drills, drill sockets and sleeves, taps, electrical fixtures, electric switches, etc. Blanks and general information relating to this circular (No. 959) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED AUGUST 3, 1915.

[Prepared by Mitchell & Allyn, 41 Park Row, New York.]

1,148,498. INSULATED JOINT; C. O. Burton, New Duluth, Minn. App. filed June 3, 1914. Bayonet-joint structure for heavy conductors.

1,148,521. TRANSMITTER FOR WIRELESS TELEGRAPHY; G. Marconi, London, Eng. App. filed July 20, 1908. Bridging studs on disk travel in gap between moving spark terminals.

1,148,522. PROCESS FOR REGENERATING ELECTROLYTES; O. C. Martin and F. Jaeger, Perth Amboy, N. J. App. filed Jan. 17, 1912. Sulphuric-acid electrolyte used in recovery of copper.

1,148,538. ANTI-THEFT DEVICE FOR INCANDESCENT LAMPS; J. Sachs, Hartford, Conn. App. filed Aug. 26, 1912. Locking ring with sealing device.

1,148,564. RAILWAY SWITCH AND THE LIKE; W. A. Austin, Omaha, Neb., App. filed Oct. 14, 1909. Self-adjusting, electrically controlled.

1,148,572. STREET AND STATION ANNUNCIATOR; E. C. Brull, Chicago, Ill. App. filed Oct. 14, 1912. Operated by trolley circuit.

1,148,592. ALTERNATING-CURRENT MOTOR; O. Knopfli, Zurich, Switzerland. App. filed April 29, 1912. Single-phase commutator-type, changeable into one having shunt characteristic.

1,148,627. SADIRON; E. E. Rose, Swissvale, Pa. App. filed Nov. 8, 1911. Terminal block in insulating handle.

1,148,628. VAPOR-ELECTRIC APPARATUS; Y. Sakai, East Pittsburgh, Pa. App. filed June 14, 1912. Rectifier; has double envelope for terminals.

1,148,639. ELECTRIC RANGE; E. G. Van Wie and R. W. Davenport, Detroit, Mich. App. filed Nov. 25, 1912. Similar to ordinary gas range

1,148,656. SHORT-CIRCUITING AND RETRIEVING APPARATUS FOR RHEOSTATS; L. and H. L. Bradley, Milwaukee, Wis. App. filed July 18, 1913. Compressible resistance columns.

1,148,661. WRITING IMPLEMENT; H. Dennis, Tracy, Cal. App. filed Feb. 13, 1915. Pencil with electric-light attachment.

1,148,662. PORTABLE ELECTRIC LAMP; O. C. Dennis, Chicago, Ill. App. filed March 2, 1914. Has a magnetic base.

1,148,665. TELEPHONE SYSTEM; A. H. Dyson, Chicago, Ill. App. filed Feb. 6, 1905. Automatic (168 claims).

1,148,696. ELECTRODE FOR ARC LAMPS; G. M. Little, Pittsburgh, Pa. App. filed March 2, 1910. Ferruginous, titaniferous and chromiferous materials and boracic acid.

1,148,699. TERMINAL BOX; A. C. McWilliams, South Bend, Ind. App. filed Dec. 21, 1912. For metering system; avoids loose wires.

1,148,700. PROCESS OF SMELTING IRON; F. J. Machalske, Plattsburg, N. Y. App. filed May 6, 1914. Subjects iron ore, graphite and basic flux to electric current.

1,148,709. COMBINED LIGHTING AND IGNITION SYSTEM; A. H. Neuland, San Francisco, Cal. App. filed Sept. 3, 1912. Magneto construction.

1,148,719. ELECTRIC PIANO; H. K. Sandell, Chicago, Ill. App. filed Aug. 5, 1913. Simplified construction for upright pianos.

1,148,750. CIRCUIT CLOSER; M. A. Button, Lamar, Mo. App. filed Sept. 4, 1914. Permutation switch for automobiles.

1,148,773. ALARM HANDBAG; G. P. Helmers, Baltimore, Md. App. filed Jan. 7, 1914. Prevents surreptitious opening of bag.

1,148,781. TELEPHONE SET; P. L. Jensen and E. S. Pridham, Napa, Cal. App. filed April 27, 1914. Combined receiver and transmitter.

1,148,787. CALLING DEVICE; J. L. McQuarrie, Montclair, N. J. App. filed March 10, 1915. Impulse sender for automatic telephone system.

1,148,788. POWER-TRANSMISSION SYSTEM; W. Morrison, Des Moines, Iowa. App. filed Sept. 15, 1914. Dynamo-electric clutch for autos.

1,148,798. ELECTROLYTIC REFINING OR EXTRACTING PROCESS; F. R. Pyne, Elizabeth, and H. M. Green, Chrome, N. J. App. filed April 20, 1915. Electrolyte in first tank allowed to stratify.

1,148,800. CURRENT-IMPULSE TRANSMITTER; J. G. Roberts, Dobbs Ferry, N. Y. App. filed Feb. 28, 1914. For control of automatic telephone switches.

1,148,808. ELECTRICAL STEAM GENERATOR; W. I. Thomson, Newark, N. J. App. filed July 23, 1909. For car heating.

1,148,827. WIRELESS-TELEPHONE TRANSMITTER; W. Burstyn, Berlin, Germany. App. filed March 25, 1909. Diaphragm influenced by electrostatic forces.

1,148,839. FLASHLIGHT; A. J. Harnack, Pittsburgh, Pa. App. filed Aug. 29, 1914. Switch conductors embedded in the material of the casing.

1,148,843. HYDROCARBON MOTOR; J. H. Hunt, Dayton, Ohio. App. filed March 7, 1914. Single transformer and interrupter for both magneto and battery circuits.

1,148,844. TUBE COUPLING FOR ELECTRICAL CIRCUITS; J. H. Jackson, South Kensington, London, England. App. filed Nov. 11, 1913. Conduit joint.

1,148,876. OVERHEAD CONDUCTOR POINT FOR ELECTRIC RAILWAYS; K. von Kando, Vado Ligure, Italy. App. filed Dec. 9, 1914. Prevents interruption of current at joint.

1,148,912. SUBSTATION SENDER CIRCUIT; A. E. Lundell, New York, N. Y. App. filed Feb. 27, 1915. Avoids noise in receiver due to making and breaking of control circuit.

1,148,923. TELEPHONE SYSTEM; J. C. R. Palmer, New Rochelle, N. Y. App. filed May 10, 1913. Long-line battery system.

1,148,936. ELECTRO-OPTICAL CELL; C. Stille, Zehlendorf-West, near Berlin, Germany. App. filed Jan. 30, 1915. Uses both sides of electrodes.

1,148,941. TELEPHONE RECEIVER; H. B. Wier, Plainfield, N. J. App. filed Oct. 28, 1913. For wireless; sturdy construction, adjustable air-gap.

1,148,986. TRAFFIC INDICATOR; C. C. Prinz, Lexington, Ky. App. filed March 24, 1914. Automobile rear signal.

1,149,001. COMBINATION CUT-OUT FOR ENGINE IGNITION SYSTEM; J. C. Sims, Maynard, Mass. App. filed Jan. 8, 1915. Permutation switch.

1,149,017. INSULATOR; R. Balliet. West Hazelton, Pa. App. filed May 27, 1914. Pole insulator; clamps wire.

1,149,038. ELECTRIC LAMP; C. Fico, Victoria, British Columbia, Canada. App. filed Feb. 14, 1914. Has an extended reflecting surface.

1,149,042. CIRCUIT CLOSER FOR SPEED INDICATORS; J. Goldstein and L. Steiner, New York, N. Y. App. filed June 13, 1914. Lights indicate speed of vehicle and show turning movements.

1,149,054. CONTROLLER FOR ELECTRIC GENERATORS; R. A. Hoppe and T. L. Lee, Rochester, N. Y. App. filed Nov. 17, 1913. For storage-battery systems.

1,149,063. TERMINAL CONNECTORS; J. A. Jones, Indianapolis, Ind. App. filed March 11, 1914. Binding-post wire clamp for lamp sockets.

1,149,064. ELECTRIC-FURNACE ABRASIVE AND METHOD OF MAKING THE SAME; H. T. Kalmus, Brookline, Mass. App. filed June 11, 1915. Fused aluminum material containing titanium oxide, magnesium oxide and impurities with metal separated from fused abrasive.

1,149,096. WIRE-SUSPENSION CLAMP; H. M. Somerville, Bluefield, W. Va. App. filed May 1, 1915. For use upon power lines where conducting wire exerts upward pull upon clamp.

1,149,099. MASSAGE MACHINE; L. J. and E. W. Wahl, Sterling, Ill. App. filed May 6, 1914. Applicator carried by armature of an electromagnet.

1,149,122. APPARATUS FOR DETERMINING DISTANCE AND DIRECTION; P. W. Fuller, Boston, Mass. App. filed April 4, 1907. For marine navigation.

1,149,123. SIGNALING APPARATUS; P. W. Fuller, Boston, Mass. App. filed Feb. 1, 1908. For determining distance and direction.

1,149,150. SYSTEM OF CONTROL; H. A. Steen, Milwaukee, Wis. App. filed Nov. 25, 1910. Prevents too rapid successive operation of the control contacts.

1,149,159. ELECTRIC, AUTOMATIC TRAIN STOP, TELEPHONE AND BLOCK SIGNAL SYSTEM; W. J. Crabbe, Drum, and H. B. Rodehaver, East Auburn, Cal. App. filed Jan. 26, 1914. Uses a third-rail divided into blocks.